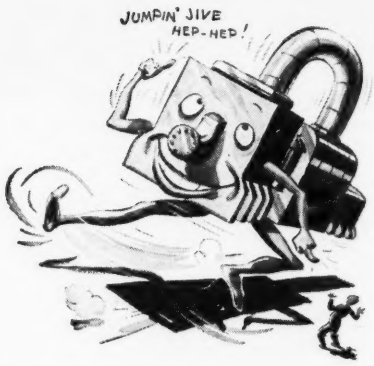
# THE CORNELL ENGINEER

January, 1942
Volume 7—Number 4

COLLEGE OF ENGINEERING · CORNELL UNIVERSITY

# *Once there was a jitterbug that weighed 800 tons!*

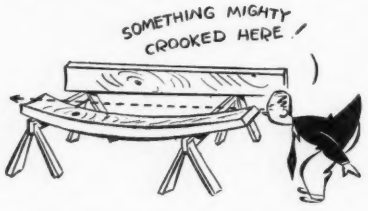



## How Westinghouse Engineers Made Vibrating Turbine Generators Calm Down

WHEN the two-pole turbine generator came along, it was hailed as a great thing. And it was. It delivered enormous amounts of amps and volts, did a titanic electrical job. But . . .

Its rotor vibrated and endangered the alignment of the bearings, collector rings, and brushes. Its stator vibrated and made the foundations tremble. And, to make bad things worse, the vibrations were different from those found in the four-pole 1800-rpm machines—and they couldn't be eliminated by the usual balancing methods. Engineers had a tough problem on their hands.

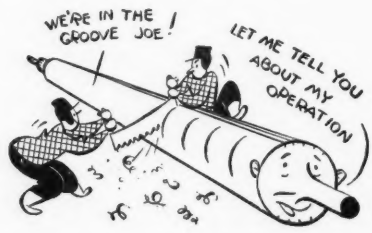
▶ Westinghouse engineers studied the rotor and found that it was acting like a two-by-four piece of wood. A two-by-four sags more lying flat than lying on its edge. It was the same with the long, slender, two-pole rotor. It sagged more lying one way than another.




This was why: Along two sides of the rotor, deep lengthwise slots were cut for the field windings. Naturally, the rotor had more give on the slotted sides than the solid sides. So, as the rotor turned, the give in the slotted sides made the downward force on the rotor supports change twice each revolution. The result: the rotor made the machine vibrate 120 cycles a second.

▶ What to do?

Dummy slots in the solid sections of the rotor would have equalized its rigidity. But Westinghouse engineers did something better. They cut several grooves across the solid sections. These grooves made the rotor's rigidity equal on all sides, *without disturbing the magnetic flux*. The turbine generator worked at top efficiency, the vibration at the supports was reduced 88%, the rings, brushes, and collector rings didn't take such a shaking-up.




▶ That took care of the rotor. But Westinghouse engineers also had to figure out what to do about the stator vibration.

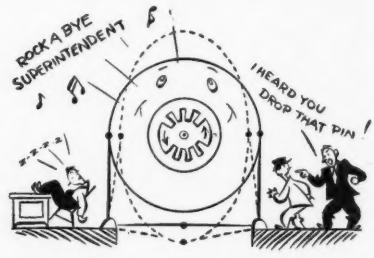
Massive as it is, the stator was being pulled out of shape, first on top and bottom, then on the two sides. The 400,000-pound magnetic force of the two-pole rotor was doing the pulling as it turned.

▶ Of course, the change in the stator's shape was too minute to be seen. But it could certainly be heard. For this change in shape was transmitted to the stator foundation as a 120 cycle vibration. From the foundation this vibration travels to floor and walls, making them hum.

To put a stop to it, Westinghouse engineers developed a special, flexible mounting for the stator. It is as though the stator were supported on two sets of links. One set goes along with the stator when it vibrates horizontally, but doesn't budge when the stator vibrates vertically. The other set goes along with vertical but not with horizontal vibrations.

▶ The effect of this ingenious arrangemen is that there is no motion at all where the links are attached to the stator foundation! The vibration at the supports is reduced by 75%, the noise lowered to less than ordinary power station noise levels!

The job was done. Stator vibration was absorbed. Rotor vibration was calmed down. Westinghouse engineers had 3600-rpm, two-pole turbine generators pouring out great electric power, and making no more vibration than machines running at half their speed.




▶ The electrical industry was through with that vibration trouble for good.

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# The CORNELL ENGINEER

Volume 7 **JANUARY, 1942** Number 4

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Published monthly—October to May—by the **Cornell Engineer, Inc.**, Ithaca, N. Y. Edited by the undergraduates of the College of Engineering, Cornell University. Entered as second class matter at the Post Office at Ithaca, N. Y., under section 103, Act of October 3, 1917.

Subscription per year: regular $1.50; with membership in the Cornell Society of Engineers $2.00 See President's page); student $1.00; single copy $.20.

—*Courtesy Rose Technic*

**Arc Welding Speeds Production**

# A History of Broadcasting At Cornell

**PROF. W. C. BALLARD, JR., M.E. '10**

*Professor of Electrical Engineering*

THE story of radio at Cornell goes back almost fifty years. In 1896, soon after the pioneer work of Marconi became known, the first crude spark radio transmitter went into operation on the campus. When conditions were just right, it was possible to signal by Morse code over the amazing distance between the Library Tower and one of the nearby buildings on the quadrangle.

Public interest in this newest miracle soon reached a high pitch, and in 1906 the first substantial transmitting equipment was assembled by the staff of the Electrical Engineering Department under the direction of Mr F. H. Kroger, then an instructor in the department. This transmitter used the spark system and was supplied by a 500-cycle generator to produce a high-pitched tone. There were as yet no radio laws or regulations; so the call letters "CV" were appropriated and communication was carried on with a few other experimental and amateur stations using any wave length that seemed most suitable.

In 1909, what is believed to have been the first "Poulsen Arc" transmitter in the United States was built and put into experimental operation. This type of apparatus is capable of being used as a crude form of radio telephone transmitter as well as a normal code transmitter. It took some time to get all the apparatus to function properly, and it was not until 1915 or 1916 that the future radio engineers were able to talk in the laboratory in Franklin basement and be heard in the nearby fraternity houses where crystal receivers had been set up. Results were far from perfect but were quite thrilling.

With the outbreak of the first World War, the activities of the radio staff were devoted to the training of radio men for the Field Artillery of the U. S. Army in a school which the Army established at Cornell. Since all amateur and experimental radio transmission was forbidden by law for the period of the emergency, the station was shut down until after the Armistice.

The World War changed the fashion in radio transmitters. The crackling spark (now seen only in the movies) was replaced by less spectacular radio tubes; consequently, new equipment of the tube system had to be installed. It was very difficult at first to obtain suitable commercial power tubes, and many of the earlier transmitting tubes in use were made in the radio tube laboratory which had been improvised some time earlier.

Under the Federal Radio Communication laws which were passed in 1912, stations such as this one were classified as "experimental" stations and assigned a call letter including the letter "X". The call assigned to Cornell was 8XU, the 8 indicating the district in which the station is located. Under an experimental license, very wide latitude of operation was allowed, the principal requirement being that there must be no interference with other Government or commercial stations. This license allowed both telephone and code transmission, and the first sporadic "broadcasts", if they could be thus named, began in 1920. The power employed was but a few watts, and the range was limited to a few miles at best. No regular program was attempted, but these tests were continued from time to time until the rules were changed, making it impossible for experimental stations to broadcast prorams of music and speech. Applications were then filed for a "broadcast" license so that these tests could be continued; in due time the license was issued, assigning us the call letters WEAI. These letters had no special significance and were assigned in rotation from the WEA-group along with station WEAF of New York, whose license had been granted a short time previously.

The possibility of the use of radio as an adjunct to the extension activities of the College of Agriculture became more and more evident, and finally through the cooperation of the General Electric and Westinghouse Companies, a 1000-watt transmitter of latest design was obtained. Unfortunately,

**AFTER graduating in 1910, Professor W. C. Ballard worked several years for the Bell Telephone Company. He then returned to Cornell as an instructor in drawing and later in electrical courses.**

**He has served as technical director of the University radio station WESG, and at present he is a member of the technical staff of the reorganized Cornell station WHCU.**

**Campus Studio of WHCU**

in addition to the transmitting equipment, radio towers, a studio, a transmitter building, etc., were also necessary; the transmitting equipment which arrived in 1926 had to wait for three years before the other components could be procured. On August 15, 1929 the station was completed, and regular broadcasting begun. The noon agricultural program, which began at this date, has continued without serious interruption up to the present.

The transmitter and towers were erected on University property along the side of Kline Road opposite the Fuertes Observatory and on the knoll overlooking Forest Home. The first studio was located in one of the rooms in the transmitter building, but on account of its inaccessibility was soon relocated in temporary quarters on the second floor of Sibley Hall, where it remained until the former Cornell Countryman building could be fitted up to house it. The campus studio is still located here, although it is believed that this building may be torn down to make way for certain improvements in the future.

### Financing Problem

One problem was immediately presented: the operating costs for a 1000-watt station are considerable, and no funds were available. One solution was the sale of time not required for educational work to some commercial organization, the proceeds to be devoted to the educational aspects of the program. Finally, contractual arrangements were completed between the University and the *Elmira Star Gazette* of Elmira, New York, whereby the University was to retain such broadcasting time as it might desire to use for educational purposes and turn the remainder over to the newspaper for commercial programs. With the assistance of the technical staff of the College, a studio was opened in the Mark Twain Hotel in Elmira, and from 1932 to 1940 the arrangement operated to the general satisfaction of both parties.

However, with a change in the personnel of the Federal Communications Commission it became evident that operational agreements of the character to which the University was a party would not be approved in the future, and by mutual agreement the contract was cancelled as of June 3, 1940.

### University Operation

This necessitated the organization of an operating staff in Ithaca to arrange programs, sell advertising time, and take care of details of operations; office and studio space also had to be provided. Arrangements were made to convert a portion of the top floor of the Ithaca Savings Building into offices and studios. Three studios of varying size cluster around a glass-enclosed control room for the monitoring operator. Offices for the staff are located nearby on the same floor. During the period of cooperation with the *Elmira Star Gazette*, the station had the service of the Columbia Broadcasting System, the news wires of the United Press, and the enormous transcription library of the World Broadcasting system; these services have been continued by the University up to the present. With the change of management, the call letters were changed from WESG to WHCU

(*Continued on page* 24)

**News From the Downtown Studio**

# Welding of Rail Joints

**To reduce wear and improve riding qualities, railroad rails are now being welded.**

**DONALD R. LUEDER, CE '44**

*Cuts Courtesy* SPERRY PRODUCTS, INC.

WITH the invention of the motor car, and the subsequent development of the bus, truck, and trailer, the railway industry has received a serious threat to its profitable operation. Railroad men have responded to this challenge with feverish activity along the lines of research, improvement, both technical and social, advertising, and legislation.

One of the most recent and important developments which has achieved partial recognition among railway men, is the welding of track joints instead of the use of angle bars and bolts. The importance of this new technique must not be underestimated. H. S. Clarke, engineer, maintenance-of-way, Delaware and Hudson Railroad said, "Advantages of welded track are so many, and so far reaching that they cannot be overlooked when, at this time, economies in maintenance are so necessary, and improved track conditions so essential."

Rail joints were constructed in the past by bringing and holding two rails in proper alignment, and then bolting plates to each side of the rail at the joint The plates were placed symmetrically, with respect to the seam, and were held secure by two bolts on each side of the seam.

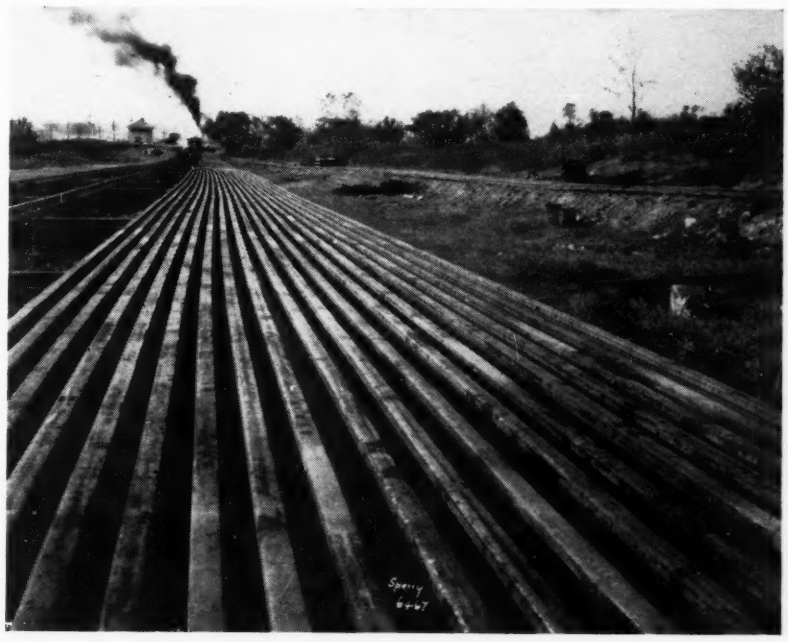
### Welding Processes

There are in use, at present, several methods of welding the joints. Among these are the Una method, the metallic electrode process, the butt weld and flash butt weld methods, and the thermit process.

In the Una process, two fish plates are arc-welded to the base and head of the rail, and on both sides of it. The gap between rail ends is completely eliminated by carefully preparing the ends and then forcing them together under compression. This compression is first obtained by mechanical means, and later maintained by welded seams. It has been conclusively shown that seam welds not only maintain the original compression, but actually augment it. The mechanical compression is obtained while setting up the joint by tightening bolts in the center holes of each fish plate (which are placed symmetrically with respect to the seam), and abutting the rails as tightly as possible with drift pins driven into the two outer holes. The drift pins are later removed and replaced by bolts.

The metallic electrode process is really a modification of the Una process. However, there are several notable differences. Two bolts, instead of two bolts and two drift pins, are used in the fish plate to maintain a snug fit preparatory to welding the seam. These bolts and their accompanying nuts are then spot welded, the bolt head being fused to the splice-plate, and the nut being fused to both the splice plate and the bolt shank. Also, while the Una method employs a dyna-motor taking current from a trolley wire, the metallic electrode method uses a gasoline driven generator. This affords an especial advantage when new trolley construction is proceeding, for tracks can be laid ahead of the overhead construction, and independent of it.

In 1921, the city of Detroit carried out an extensive program of new construction, in which all of the joints were made by the metallic arc welding process.



**Steel Rails 1500 Feet in Length**

By far the most important and widely used welding techniques are the butt weld and thermit methods.

The butt weld process employs no plates, bars, bolts, or extra material of any kind in joining two rails. The rails are simply welded together, end to end. The entire end

surfaces of the rails are uniformly heated by interposing a flux between them. This flux is heated above the welding point of steel by passing an electric current through it. When the end surfaces of the rails reach a welding heat, they are forced together by hydraulic clamps which hold the rails throughout the procedure.

Two factors make this a remarkably strong and durable weld:

(1) Coarse crystallization is prevented because of the forging effect produced by the hydraulic clamp pressure. The pressure is maintained while cooling progresses.

(2) Oxidation is prevented by the flux, which excludes air from the welding surfaces of the rails.

The flash butt weld is a form of butt welding in which a butt weld is made quickly. A light contact pressure is first applied. This is followed by a period of sparking without pressure. Finally a heavy pressure is used, together with enough heat to melt part of the metal.

After the heavy pressure, the excess melted metal is thrown out in a burr, which is then chipped off and ground down to the contours of the rail.

In flash butt welding, the space between the clamping jaws of the machine is very small. This prevents the stock from bending when the pieces are brought together.

The thermit process, discovered by Goldschmidt, is based on a chemical reaction between iron oxide and aluminum. When such a mixture is heated to a high temperature at one point, the reaction so started proceeds throughout the entire mass. This is because the aluminum reduces the iron oxide, to form super-heated, molten aluminum oxide, and super-heated, liquid steel. The temperature of molten steel has been theoretically determined by metallurgists as being about 5000 Fahr. This is almost twice the temperature of ordinary liquid steel. It can be easily seen that such liquid metal, if poured between other pieces of red hot metal, will dissolve and absorb them into a single mass, which will solidify homogeneously upon cooling.

There are two adaptations of the thermit process which are generally used in railway work; they are commonly know as the insert system and the pressure butt weld system.

In the insert system a loose insert of rail steel is placed between the rail ends. The base, web, and part of the head of the rail are then fusion welded. A butt weld is obtained on the insert. This thermit method is usually used on track which is already in position or service.

However, on main-line railroad track the rails carry a much heavier load, and there is a compression stress on the head of the rail due to the lack of a solid foundation such as concrete. These factors make a 100% welded head highly desirable, if not necessary. It is for this type of work that the pressure butt method is used.

Like the insert system, the pressure butt method uses a thermit fusion weld on the base and web of the rail. However, the head of the rail is welded by pressure.

The rail heads are brought to welding temperature by the heat produced from the thermit reaction. They are then forced together under high compression by large clamps which are drawn up at the proper time. Thus, a perfect butt weld is secured. Tests on this type of weld tend to show that the break generally occurs entirely outside of the weld.

Although this method of welding is slightly more expensive than the insert method due to the additional equipment involved, the expense is well warranted in the joining of main-line track.

The Delaware and Hudson Railroad, in 1937, after some years of extremely favorable experimentation, decided to weld several miles of its main line track in long lengths. The D. and H. used a Sperry welding, annealing, and grinding mobile train unit, consisting of several cars in which the equipment was installed, and a long line of flat cars which held the completed rail. The rails were completely "finished off" by a technique resembling the assembly-line system of the automobile industry.

### Traveling Welder

The first car contained a rack of 39-foot, 131-16 rails; these were delivered to the welding equipment in the next car by means of power-driven rollers.

In the welding car, the rails were fused by the flash butt weld method. Each weld cycle consumed six minutes—a cycle included the welding, annealing, and grinding operations.

On the following car the rail passed through a stress-relieving furnace. The upset metal at the head of the rail was then ground down by a gage grinder, the excess fillet metal was removed with an intermediate grinder, and a third grinder smoothed the head of the rail still further. Finally an accurately controlled abrasive block smoothed and contoured the rail.

The long welded rails (some thousands of feet in length) were transported simply by passing them back along the string of flat cars which was coupled behind the Sperry unit. The long lengths or rail gave no difficulty when rounding curves. They bent and straightened as required without even being

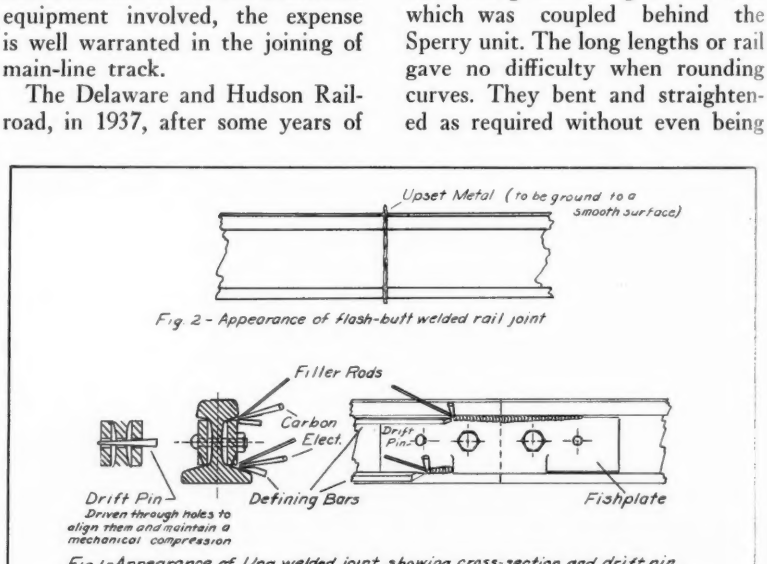


Fig. 2 - Appearance of flash-butt welded rail joint

Fig. 1-Appearance of Una welded joint, showing cross-section and drift pin

fastened to the cars.

Unloading was accomplished by fastening a cable to one end of the rail and anchoring the cable to the ground. The train was then hauled away, leaving the rail to practically unload itself beside the track which it was to replace.

The welded rails were fastened to the ties by spring clips which exerted a force of 2500 pounds on the rail base. Rails were laid in long lengths, broken only by insulated signal circuit points. The long lengths of rail were joined by a thermit weld.

In reference to the method described just above, the Delaware and Hudson Railroad says, "Welded joints eliminate the "click" of wheels passing over open joints; eliminate flattening of the rail ends, which necessitates repairs; eliminate rail replacement due to excessive end wear; and give a more comfortable ride . . . The resistance to movement produced by the (spring) clips and bedded ties is greater than any force of expansion or contraction in the rail. Once laid in track, therefore, welded rail remains rigid."

In one of the West Virginia mines of the Koppers Coal Company the grades are severe, and 20-ton locomotives, operating in tandem, are used for hauling. Nevertheless, the joints in the welded track have remained in perfect condition without any attention whatever.

When rail joints are secured by bolts alone, they must be inspected and tightened every few weeks. Welded joints need not.

While worn or poorly fitted angle bars are unsatisfactory in holding bolted rail joints, they are as useful as new ones in constructing welded joints.

In 1933, the Delaware and Hudson Railroad, in cooperation with the Metal and Thermit Corporation, welded a stretch of experimental track. This was done during the hot weather of August. Three hundred welds were made, as well as a few regular joints and one expansion joint.

Five of the 300 welded joints failed. Two failures were due to defective welds. The other three, which occurred during periods of extreme cold, were identified as welds that had been left for expansion during the progress of the work, and later welded up. This resulted in faulty welds and excessive strains. On the northbound track there were no failures; all of the joints on this track had been welded consecutively. It was also observed that there was no more expansion and contraction at the ends of the welded track than there was in the 39-foot rails of the regular track.

**Unloading: Strip of welded rail is anchored to track and flatcars are pulled from beneath it.**

Advantages of long lengths of welded track was summarized by the D. & H. as follows: "Savings in maintenance cost; longer life of rails, due to elimination of joint batter; labor saving in laying rails, due to increased life; better conductivity in track circuits; and elimination of necessity for bonding joints."

In tests conducted by Dr. G. P. Boomsliter of West Virginia University, it was found that a plate beneath the rail, at the joint, strengthened the weld considerably. It did not seem to affect the strength of the weld when the web was left unwelded. He also found that under repeated stress, the stress in any joint depended on the solidity of the roadbed beneath it. Dr. Boomsliter further observed that electric welding develops a brittle zone behind the weld and urged that reheating to remove this brittleness was highly desirable, even though more expensive.

In 1937, a study of continuous welded rails was begun by the American Railway Engineering Association, in cooperation with the University of Illinois Engineering Experiment Station. Their study showed that welded joints may actually be strengthened by being subjected to many cycles of stress below the fatigue limit of the original material. This phenomenom of strengthening metals by repeated understress has been known for several years, *and repeated understress is just what rail joints receive in service, toether with a rather rare overstress.*

### Conclusion

The innumerable advantages of welded rail tend by far to offset any objections to its use. Such desirable qualities as a higher fatigue limit, and an assurance of long life under service loads will undoubtedly be incorporated into welded rail joints in the future, as welding and installation techniques are perfected and research leads the way to new and better methods and materials.

# Sanitation in The Design of An Army Camp

**PROF. W. E. STANLEY**

*Professor of Sanitary Engineering*

EXPANSION of the Army in the Defense Program has involved extensive engineering planning of temporary housing facilities. The Construction Division of the Army has planned a considerable number of camps with capacity to house 30,000 troops and auxiliary personnel, a limited number of camps with capacity of 60,000 to 80,000, and other camps to house less than 30,000.

Temporary housing and utilities are designed in general on the basis of an anticipated five years of life. However, the planning must include consideration of many of the factors which would be considered in planning a longer term development. Wooden buildings with concrete foundations comprise, in general, the main structures, with certain utility structures—such as water works and sewage treatment plants—of reinforced concrete.

The sanitary facilities required for an Army camp are quite similar to those in a sizeable city. Thus, there are required facilities for water supply, treatment, storage, and distribution; sewerage and sewage disposal; garbage and rubbish collection and disposal; grease traps; including shower baths; central toilets and urinals; washing facilities laundries; heating and ventilation; surface and storm water drainage; mosquito control; and recreational activities.

Providing an adequate and wholesome supply of potable water is an item of great importance. This is not always an easy task. At least one camp site has had to be abandoned and the camp relocated due, in part, to the unsatisfactory quality and quantity of the water supply.

An early reconnaissance survey for the proposed camp showed two possible sources from which a camp water supply might be developed, one being a surface supply from a nearby river and the second being from wells.

### Water Supply Sources

This river drains an area of about 570 square miles above the most likely location for a water supply intake. A dam was already available at about the proper location. However, the minimum stream flow was relatively low, being estimated about 17 c.f.s. Although reasonably sufficient in quantity, the quality would likely be inferior as a small town located adjacent to the stream, near the proposed water supply intake, would likely serve as the nucleus for the settlement of a considerable population when the proposed camp was developed. Also considerable additional population would likely settle on the water shed above the water supply intake.

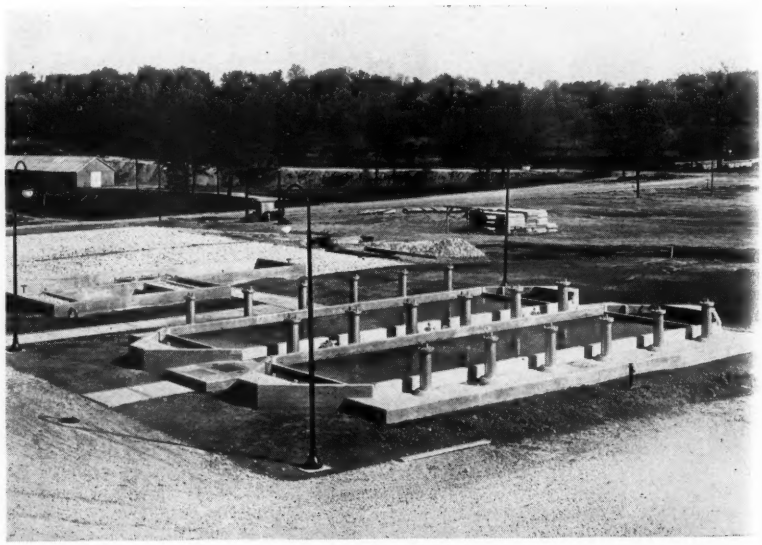
Thus, the water from the surface supply would likely receive considerable pollution. In any event a filtration plant of about 5.0 M.G.D. capacity would be required together with low-lift and high-lift pumping stations.

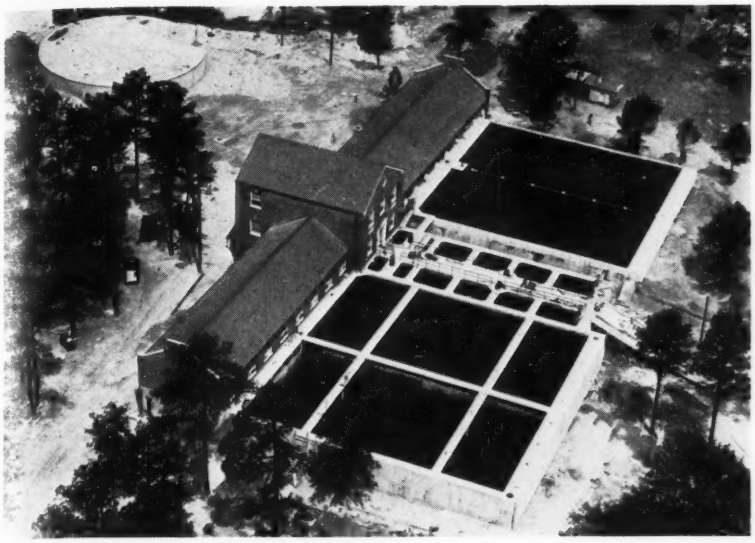
Early in the planning period it was decided to investigate the possibilities of a well-water supply. A number of small communities along the nearby river valley had obtained water supplies from shallow wells. All available records were collected of existing wells and the logs of a number of attempted wells, including several gas and oil test wells. These were used as guides in determining the most likely locations of water-bearing strata and proved to be quite useful.

A test well drilling contract provided for the drilling of a series of 18 test wells, 6 inches in diameter. At one time as many as four drilling rigs were on the job working 24 hours a day.

Test well logs and pumpage tests indicated a water-bearing gravel with an average width of possibly 6000 feet, an average depth of about 40 feet, and an undetermined length up the valley. The pumpage

**Chlorination Chamber and Filter Bed**





**Water Filtration Plant at One of the Camps**

tests gave evidence that 6 to 8 wells, 12 inches in diameter, might produce 700 gallons per minute each.

There was some uncertainty as to the effect of any continuous pumpage from the gravel strata on the ground water level in the strata. Accordingly, it was decided to arrange the contracts and specifications so as to require the construction of two 12-inch wells and the running of extended pumpage tests on these two wells for a period of 10 days or more—the purpose being to determine the lowering effect, if any, on the ground water level as shown by drawdown measurements in drill holes placed at various distances from the wells. On the basis of these pumpage tests and the drawdown measurements the number and spacing of additional wells would be determined.

To provide water for a camp of 35,000 would require, on an average, about 3.5 to 4.0 million gallons every 24 hours. In order to transport this quantity of water to the cantonment area, an 18-inch pipe line about 18,000 feet long and a high-lift pumping station with a total installed pumping capacity of eight million gallons per 24 hours would be required. Three elevated storage tanks, one of 300,000 and two of 500,000 gallons capacity would be needed to provide fire protection and to supply peak hourly rates of water demand. The construction cost of the water supply system for the proposed Army camp was estimated as being in the magnitude of $1,300,000.

Each barrack building, designed to house 74 men, includes a basement at one end in which are located showers, lavatories, and toilets; a coal-fired water heater in an adjoining basement room provides hot water. The operation of the toilets, urinals, and showers requires a large supply of water—in some camps the total has been as much as 200,000 gallons an hour.

### Modern Requirements

These facilities, with their demand for large water quantities, represent one reason why the sanitary facilities of modern camps require more attention and are more costly than during 1917-1918, when a goodly number of cantonments did not include such liberal facilities. In addition to these requirements considerable water is needed for kitchens, hospitals, wash racks, street and sewer flushing, and fire protection.

Early in the program of constructing camps it was anticipated that average daily per capita water consumption would be as shown in table A.

Operating experience at a number of camps indicates that these unit water consumption allowances have been satisfactory. Some few camps have used larger water quantities due to wastage by continuous flowing urinals, defective toilets, and failure to shut off showers when not in use. In other camps where water was relatively scarce, a considerably lower unit per capita water supply has proven reasonably satisfactory.

Improvements are being made in an attempt to reduce water wastage by installing automatic flush valves and by a closer control of the maintenance and operation of plumbing fixtures. Additional supplies are being developed for those few camps in which water supply sources have been limited.

A complete system of sanitary sewers is required, including a connection to every building in which water is supplied, lateral sewers, trunk, and outfall sewers and sewage treatment works. The camp needs a total of about 227,000 lineal feet (43 miles) of sewer lines ranging from 6-inch to 30-inch in size. The outfall from the camp to the river has a length of about 12,000 lineal feet. The total construction cost of the sewers and treatment plant has been estimated as being in the magnitude of $885,000.

Camp sewage will be discharged into a nearby river about 12 miles upstream of the water supply intake for a city of 12,000. Thus a very reliable and fairly complete type of sewage treatment is required, including chlorination to insure destruction of any disease germs which might be left in the sewage.

The proposed sewage treatment plant comprises bar screens, a Parshall measuring flume, preliminary settling tanks, four trickling filters each 145 feet in diameter with rotary sewage distributors, final set-

(*Continued on page 22*)

TABLE A

| *Type of Military Force* | *Per Capita* |
|---|---|
| Triangular Division | 100 Gallons/day |
| Armored Division | 150 Gallons/day |
| Hospital Area | 150 Gallons/day |

# The COLLEGE . . .

## Library Remodeled

LIBRARY facilities of the Schools of Mechanical and Electrical Engineering in Sibley Dome will be greatly enhanced on the completion of extensive remodelling of the mezzanine which was begun last month. A University appropriation will make possible the doubling of the seating capacity, the installation of fluorescent lighting, and the erection of an interior stairway, connecting the main floor with the mezzanine.

The use of the library by the engineering students has increased greatly since its removal to the Dome in the autumn of 1939 with W. H. Hyde, Jr., as librarian. Under his direction the library has been completely reorganized and catalogued, many new volumes added, and the hours extended.

The library now has nearly 10,000 volumes and 200 technical journals. Last year students used a total of 10,171 books in the library and borrowed 2500 for home use. This represented a gain of more than 100 per cent over the preceding year.

The facilities of the library are used by students for study room purposes as well as for reference. Modern teaching methods require an increasing use of library material for classroom purposes. As a consequence the 75 seats in the library are taxed beyond capacity during the peak hours between 9 and 11 a. m. With the new installations there will be accommodations for 175 students.

Eventually it is planned to bring the library of the School of Civil Engineering into the Dome and thus consolidate all the library facilities under a single administration and supervision.

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## Eta Kappa Nu Elects

ETA Kappa Nu, national electrical engineering honor society, initiated the following new members at a banquet held on Tuesday evening, December 16: Charles W. Brand, Frank K. Faulkner, D. Brainerd Holmes, Robert E. Hutton, Donald L. Johnson, Raymond V. Pohl and Dean B. Wheeler. All are juniors.

With the help of Professor M. G. Malti, the society is now engaged in renovating and classifying some ancient electrical equipment stored in Franklin Hall. Much of this apparatus is of definite historical value, but since so little is known about it, the items will be photographed and the pictures sent to people who might be able to supply the necessary data. When properly classified, the equipment will be put on display as a sort of museum.

The present officers of Eta Kappa Nu, elected last May, are: John Aldworth, president; F. Brendan Burke, vice-president; Stanley Thorne, corresponding secretary; George Critchlow, recording secretary; and Leonard Schley, treasurer.

The following men have been elected by their classmates to serve this year on the EE student committee on academic conduct: George Critchlow '42, Tom Wilson '42, Ray Pohl '43, and Milton Stolaroff '44. The election was sponsored by Eta Kappa Nu, with Jimmie Wray Killian in charge.

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## Hints For Employment

MR. Paul W. Boynton, supervisor of employment for the Socony-Vacuum Oil Company, talked to the seniors on the "Six Ways To Get a Job" on Friday, December 5. He has interviewed upwards of 80,000 men, chiefly for positions in the foreign branches of the company.

He pointed out that life is a selling job—you must be able to persuade and favorably and constantly impress others. Before going into an interview, he said, put yourself into the interviewer's place; what would you like to know about a college student whom you might possibly hire for the company? Other suggestions were that you find out beforehand something about the interviewer so as to help you make the right approach and that you take your cues from him.

The hardest thing for a student to learn, he said, is when to leave; don't stay long enough for the interviewer to become impatient, but politely say, "If you have no further questions to ask of me, I believe I'd better go; there are several others waiting outside to see you." The six ways a college graduate can get a job are through 1) A university placement bureau, 2) friends, 3) personal solicitation, 4) letters of application, 5) commercial agencies, and 6) advertisements.

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## ASME Meets

MR. G. Cole of the Wright Areonautical Corporation of Paterson, New Jersey, showed an excellent sound film entitled "Wright Builds for Air Supremacy" at the December 9 meeting of the ASME held in Baker Laboratory. The picture was preceded by a talk by Mr. Cole on the work and history of the company.

He pointed out that at present the internal combustion engine is providing 1,000,000,000 horsepower to the automobiles and trucks on the open road and about the same to planes in the air.

Explaining that 8 to 10 years of testing are required before a new model is produced, he went on to say that there are three goals in engineering work in the airplane industry. These are: 1) the need for greater horsepower, 2) reduction in weight, and 3) reliability and endurance.

Indicative of the advancement of the aviation industry along these lines, he pointed out that the horsepower per engine was not long ago about 1200, whereas in the new B-19 bomber there are four engines, each rated at 2200 horsepower. To show reliability and endurance, Mr. Cole stated that no major overhaul is required for less than 500 flying hours and that during the emergency the airlines have been in operation continually for 17 out of every 24 hours. Airline engines, he said, generally last for five or six years of active service.

Wright is the only airplane manufacturer that does its own foundry work; the cylinder heads are cast in one solid piece of aluminum. Roughly 84 hours are required from

the time the casting is made until the engine is finished. Each engine has 52,000 inspections, and a 7-hour test run before it leaves the factory. After these test runs the engines are completely torn down and thoroughly inspected for defective parts.

Formerly there were as many as 1400 design changes a year for each model, but due to the war, the models have been "frozen" to permit mass production.

## AIEE Appoints

DIRECTOR William A. Lewis, Jr. of the School of Electrical Engineering and Everett M. Strong, associate professor of electrical engineering, have been appointed chairmen of the AIEE national committees on basic sciences and on production and application of light, respectively. Dr. Lewis has served since 1933 on AIEE committees on education, power, protective devices, and research. Mr. Strong has served on committees on student branches and education. He was appointed associate professor just last summer.

## Naval Commissions

JUNIOR and senior engineering students who are candidates for degrees have an opportunity of securing appointment to a commissioned rank in the United States Naval Reserve, according to an announcement made by Dr. Arthur S. Adams, assistant dean of the College of Engineering.

Members of the senior class who apply under this program may be commissioned Ensigns, Volunteer (Special Service) upon graduation and receipt of degree. Members of the junior class may be commissioned immediately upon approval of application as Ensigns in probationary statues, subject to transfer upon graduation and receipt of degree, to Ensign, Volunteer (Special Service). There are also special appointments.

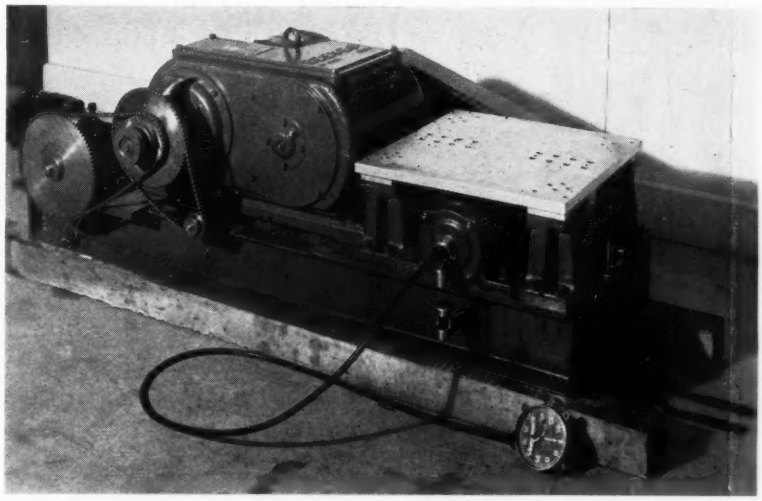
Upon their own request, members of the junior class who are commissioned Ensigns, probationary, will be ordered to temporary active duty for indoctrinal training during the summer vacation months, with pay.

Individuals who accept commissions will now be ordered to active duty. In time of peace, active duty is voluntary.

Candidates must be not over 26 years old, must be citizens of the United States, or a 10-year resident-naturalized-citizen, and must pass a physical examination.

## Instrument Tester

A MACHINE that simulates the vibrations set up in airplanes has been developed by Mr. Walter A. Johnson, of the Department of Machine Design, in order to test aircraft radio equipment. The new design is similar to two other machines of this type that Mr. Johnson has designed, one of which is at Wright Field in Dayton, Ohio and the other of which is at the Westinghouse Research Laboratories in Pittsburgh, Pa. The new machine will be sent to the Philco Radio and Television Corporation of Philadelphia after electrical tests being conducted on it by George Robertson of the School of Electrical Engineering have been completed. The design of the table holding springs and an improved lubrication system are noteworthy improvements over the older designs. An increased main bearing size allows larger sets to be tested and an automatic frequency control has been added. The new machine has an increased frequency of vibration of 2000 per minute, and its appearance has been streamlined.



**Machine for Testing Aircraft Radio Equipment**

## Engineering Research

CONSIDERABLE research work is now being carried on in the Department of Mechanics under the direction of Professor J. N. Goodier. Professor W. T. Thomson and Professor Goodier are preparing a paper on the relations between structures and their models which are frequently made for preliminary testing and design checking. This is of particular importance in testing aircraft structures for stiffness and strength. An application of the "theory of dimensions" leads to new rules for the prediction of stress and deformation in the structure from the measurements made on the models.

Professor G. H. Lee is doing research work in strength of materials which promises to yield a simple explanation and analysis of the behavior of the Bourdon pressure gauge. Work is being done to improve on its action, so far complicated and unsatisfactory, in order to distinguish the significant features of the variety of tube shapes used, the unimportant features, and to facilitate the making of new designs.

Dr. D. C. Drucker has been developing a method for measuring stresses in plates bent by pressure

(*Continued on page 22*)

# Senior Class, 1942, School of Electrical Engineering

. Blake, W. R. Babylon, N. Y.
. Buchter, T. W., Flushing, N. Y.
. Matten, C. W., Jr., Wyomissing, Pa.
. Mead, B. D. (Miss), Amityville, N. Y.
. Hollister, S. C. (Dean)
. Lewis, W. A. (Director)
. Gruen, F. E., Tonawanda, N. Y. (A.E.)
. Lorber, R P., Vineland, N. J.
. Perry, E. L., Rensselaer Falls, N. Y.
10. Gurnee, R. M., St. Albans, N. Y.
11. Cochrane, J. W., Augusta, Ga.
12. Wilson, T. M., Hall, N. Y.
13. Littleton, J. C., Corning, N. Y.
14. Hollister, J. G., Ithaca, N. Y.
15. Sullivan, J. B., Rochester, N. Y.
16. Schley, L. L., Brooklyn, N. Y.
17. Lipetz, L. E., Bronx, N. Y.
18. Killian, J. W., Brooklyn, N. Y.
19. Human, D. W., Niagara Falls, N. Y.
20. Lipkin, H. J., Rochester, N. Y.
21. Brodzinsky, A., Buffalo, N. Y.
22. Deabler, H. E., Schenectady, N. Y.
23. Burns, W. W., Jr., Washington, D. C.
24. Schwarzkopf, D., New Rochelle, N. Y. (A.E.)
25. Williams, F. E., Jr., Rye, N. Y. (A.E.)
26. Critchlow, G. F., Trenton, N. J
27. Burke, F. B., Buffalo, N. Y.
28. Thorne, S. R., Johnson City, N. Y. (A.E.)
29. Tredennic , H. L., Johnstown, Pa.
30. Sloughter, W. J., Ithaca, N. Y.
31. Noble, F. W., Gainesville, Fla.
32. Dame, R. O., Garden City, N. Y.
33. Smith, H. R., Glen Ridge, N. J.
34. Perkins, C., Milwaukee, Wisc.
35. Aldworth, J. G., Garden City, N. Y. (A.E.)

# Senior Class, 1942, School of Civil Engineering

1. Sofair, M. N., Baghdad, Iraq
2. Tugal, M., Ankara, Turkey
3. Young, W. F., Cortland, N. Y.
4. Leighton, P. W., Twin Falls, Idaho
5. Hollister, Dean S. C.
6. Malcolm, Director W. L.
7. Howell, Professor E. V.
8. Shaw, J. W., New York City
9. Burton, F. C., Canastota, N. Y.
10. Dobson, A. A., Lincoln, Nebr.
11. Go, M. L. P., Amoy, China
12. Keretli, A. K., G. Antep, Turkey
13. Peterson, L. E., Milwaukee, Wis.
14. Hildabrand, T. J., Altoona, Pa.
15. Wagner, R. L., N. Hollywood, Calif.
16. Smith, W. P., Braintree, Mass.
17. VanOrder, E., Ithaca, N. Y.
18. Bundy, D. L., Ridgewood, N. J.
19. Entenman, A. M., Crestwood, N. Y.
20. Findlay, R. C., Irvington-on-Hudson, N. Y.
21. Tripp, J. G., E. Orange, N. J.
22. Simpson, H., New York City
23. Ting, R. E., Shanghai, China
24. Ates, T., Erzinean, Turkey
25. Bean, J. W., McGraw, N. Y.
26. Rosen, P., New York City
27. Rodriguez, L. F., Santurce, P. R.
28. Calderon, A., Aquadilla, P. R.
29. Brinckerhoff, C., Mt. Vernon, N. Y.
30. Walker, E. S., Waverly, N. Y.
31. DeLia, S., New Hartford, N. Y.
32. Wright, D. L., Washington, D. C.
33. Boyer, J. L., Palmerton, Pa.
34. Eberle, W. D., Jersey City, N. J.
35. Miller, E. G., Pelham Manor N. Y.
36. Rupley, G. M., Buffalo, N. Y.
37. Hansen, J. M., Litchfield, Conn.
38. Goodkind, D. R., New Brunswick, N.
39. Milhan, D. W., Pueblo, Colo.
40. Burkhardt, D. T., Quincy, Mass.
41. MacDowell, R. L., Odessa, N. Y.
42. Mattern, J. F., Thompsonville, N. Y.
43. Acker, L. M., Lakeville, N. Y.
44. Rothwell, F. N., Honolulu, Hawaii

# What Are We Going to do About It?

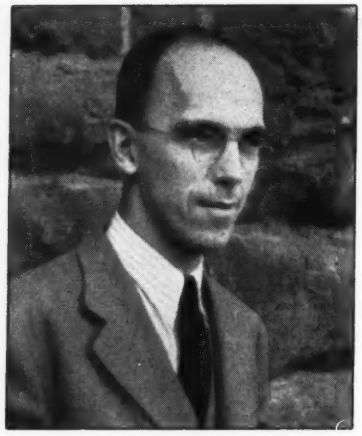
ON December 7, 1941, the United States of America was attacked by the Imperial forces of Japan. On that day we were forced to discard our visions of peace and accept the realities of international war. The time had come for each of us to determine what our contribution to the national effort was to be. Students in the College of Engineering were placed in a difficult situation by the crisis. Our problem was to choose between immediate enlistment in the armed forces and the continuation of our education. We elected to remain in school. This action was in direct contrast to the response of Cornell engineers in World War I when wholesale enlistment was the order of the day. And it was not an easy thing for us to remain here when the urgency of the situation and the clamor for punishment of the Japanese beckoned us. Perhaps there are some individuals who would regard this action as being opposed to the tradition of Cornell, but if we did forsake a tradition, we did so with good reason. We were aware that this was going to be a struggle between forces of production as well as forces of armed men. The facts are that in this war, every man wearing a uniform must be supported by fifteen men wearing overalls. These facts speak clearly enough.

But the mere continuation of our training as engineers is not enough. We must deal with our education as though it were a military objective; each subject must be thoroughly reconnoitered and then attacked with the energy it really deserves and allowing a difficult course to lapse into the background should constitute treason. Unfortunately, it is easy enough for each of us to assume an attitude of detachment and say to ourself, "What difference does it make if I put in a little extra time on my studies? There are plenty of men better than myself who will probably get the important jobs anyway." But today, every engineer is important, whether he is at the top or bottom of class. The production effort is so large that every engineering graduate will receive a job or responsibility, and if that responsibility is taken by a half-trained man, there will be just one more obstacle to our production. Of course, we can not expect to be as well-trained as men who have practiced the profession for many years; the limitations of an academic education prevent this, but we can equip ourselves with all the knowledge that is at our disposal.

Not only does the war require more effort from the students; it also demands more energy from the faculty. Many instructors and professors have accepted research work of a military nature in addition to their regular instructional duties; the added work may result in less energetic instruction. However, if the students are to measure up to higher standards, the instructors must necessarily raise their standards of teaching. The poor or uninteresting lecturer should exert himself to present his material so that it really gets across; the instructor who says, "It's all in the book," should realize that even textbooks can be vague; and all of the faculty should remember that a little bit of inspiration goes long way to produce good engineers.

We shall hear talk of how everything was made easier for engineers at Cornell during the last war; of how the University administration plans to make it easier for us to complete our courses because of this war. This is the sort of thing that is pleasant to hear and easy to accept, but it is rumor in its most malicious form. This is the sort of rumor that destroys morale most effectively, because it carries tidings which are extremely pleasant to hear and which are easy to spread around. But this is wishful thinking; and wishful thinkers have never won anything.

—THE EDITORS



AE Professor

## Prof. G. R. Hanselman

HIKING across the snow-covered fields bearing his gun and candid camera, Professor Hanselman may be caught, in season, at one of his favorite hobbies—hunting rabbits with the assistance of his hunting dog. When the hunting season closes, he will still be seen roaming the fields, but his hunting will confine itself to the harmless role of shooting pictures of wild life.

When the weather does not permit outdoor activity and he can spare some time from his scholarly role of professor in business law and accounting, he devotes a few minutes to his campus-famous collection of from 6000 to 7000 book matches, which he keeps classified as to color.

But Professor Hanselman is hardly here just to enjoy the outdoor life or work on his match collection. He has plenty to do teaching accounting and business law to the AE seniors and also serving as their adviser. Let's go back and pick up his "vital statistics" during his life as an undergraduate at Cornell.

In the fall of 1918 he started his freshman year at Cornell in ME. At that time the University operated with a three-semester college year, and R.O.T.C. and S.A.T.C. trainees under orders to wear their uniforms at all times were a common sight on the campus. Besides working his way through school, he found time to go out for the baseball squad, was elected to Atmos, and was a member of the Pi Kappa Phi fraternity.

Upon graduation he remained at Cornell doing graduate work; he majored in business law and minored in accounting. In 1923 he began his teaching career as an instructor in frosh "Descript", in which capacity he remained until the AE department was founded in 1931. At that time Professor Hanselman was chosen to teach accounting, which he has been doing ever since. While working in his spare time for his M.S. in law (which he received in 1936,) he prepared and had published three case books for use in the engineering business law course started in 1935. Today his course in business law is one of the best of the AE courses; it is administered in an informal way that makes it an interesting and vital subject to the 150 students who take it each term.

Professor Hanselman became an assistant professor in 1936 and last fall was made an associate professor. He is co-author of a book recently published, entitled "Accounting for Engineers", which is being used this term in the elementary accounting courses.

His outside interests include director of the local chapter of the National Association of Cost Accountants, member of the American Accounting Association, and S.P.E.E., and honorary member of Kappa Tau Chi, honorary society in AE. Professor Hanselman is also conducting a defense course in cost control at Binghamton.

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## Ching Te Wu

CHING Te Wu, better known as Carl, is one of those rare lads who decided that when he went to college, he was really going to study. He has done just that. His reason is a good one, for when he returns home, there will be a real task to perform. As he says, "It is the ambition of every youth in China today to serve Free China to the best of his ability."

Carl attended high school at Hong Kong and then attended the University of Hong Kong to study mechanical engineering. During his last summer in China, he supplemented the university training by learning the "ins" and "outs" of a textile mill in Tientsin. He worked at every operation necessary to produce the finished cloth. This extended from the spinning of worsteds to the final dyeing.

In early October of 1939, Carl transferred to Cornell University in order to learn something of administration in mechanical engineering. Upon graduation from Cornell, he hopes to help apply modern methods of efficiency and management to industries in China. He says that he has learned one outstanding thing in America, that is, the art of being practical.

He has made his sojourn at Cornell profitable not only by maintaining a high scholastic average but has also found time to be an active member of the Cosmopolitan Club, the Chinese Students Club, and the Cornell-in-China, Inc. In addition to these activities, he has given numerous talks about China at the various local churches. During his two years at Cornell he has attended both summer sessions. This last summer, after summer school, he drove 4,000 miles on a trip through New England and Middle Eastern States. He visited Boston and Washington, and made inspections of M.I.T., Harvard, and Lowell Institute of Textiles.

(*Continued on page* 28)

Carl

## Among Cor... Engineer

**This month... roduc... foreign stu... enrol... the Colleg... Engin...**

## ...ong Cornell's ...Engineers

**...s month... ...troduce three ...ign stu... ...enrolled in College ...Engineering.**

### Pierre Yakovleff

A NEWCOMER to Cornell and a refugee from his native France, Pierre Yakovleff, '44 Chem E, has already lived an exciting past. After an interesting life on the continent, and a marvelous escape from Vichy France, he arrived in the United States early this year to study Chemical Engineering, and he picked Cornell for his alma mater.

Pierre was born in Czechoslovakia, but his family moved to Paris when he was two years old. He went to high school near Nice on the Riviera, where his father was the manager of a hotel. Since he has always wanted to be a scientist, he attended the Institute of Industrial Chemistry at Lyon. There, he pointed out, the relation of the industrial school to the university is very different from that here in the United States; there, the industrial school is only associated with the university, while here it is a part of the university.

His summers were spent in an interesting manner. In the summer of 1938, he went as one of a group of 30 exchange students for a three month's course in the University of Brashov, Rumania, where there was a large concentration of Germans, of whom we have heard so much in the past few years.

Two other summers he spent at work for a perfume manufacturer in Grasse, which is the center in France for the preparation of perfume oils. One summer he worked in a lab extracting the oils from flowers, and the other summer he was sent to the mountains to buy flowers for his concern.

1940 proved to be the climax of his life in France, however. He had been studying in the Institute of Industrial Chemistry for two years, working for a chemical engineering degree, when the war broke out. For a while, he only took the compulsory military training of his

(*Continued on page* 24)

Pierre

### Mateo Go

WHEN MATEO GO first came to Cornell four years ago, he knew very little English. In the first few weeks he had to translate almost every word with the aid of a dictionary. He wore out five dictionaries in that year, but in doing so mastered English and his studies well enough to win the Chi Epsilon Freshman Scholarship Award. Now, he is one of the top men in his class and has a sizeable list of activities.

"Mat" was born in Amoy, China but has lived most of his life on the island of Cebu, Phillipine Islands. After he had graduated from a Chinese high school in Cebu City, he decided to study civil engineering in the United States. He came to Cornell because it was recommended to him by all the engineers whose opinions he sought. Once here, he began to carry out an ambitious plan of completing the four year civil engineering course in three years.

In his second year, Mat won the Sophomore CE prize for top marks in his class. As a junior, he was awarded a McMullen scholarship and was elected to Chi Epsilon. Unfortunately, he sustained a serious head injury during his junior year which caused him to miss the Dean's List and give up hopes of graduating in three years. This year he was elected to Tau Beta Pi.

Mat

High marks and crowded schedules do not occupy all his time. For the last two years he has been the secretary-treasurer of Rho Chi, a fraternity of Chinese students. Mat is the treasurer of the Cornell Chinese Engineering Student Association and the president of the Cornell-in-China, Inc., an organization which promotes good-will between the United States and China by doing all it can to interest Chinese students in coming to Cornell. He is an associate editor of the Cornell Chapter of the "Transit", the Chi Epsilon publication. Mat was also an active member of the Junior Day Jamboree Committee. With all these activities, he still has time to pursue his hobby of photography and to play his favorite sports of badminton, soccer, and tennis.

In order that he might graduate in three years, Mat has attended summer school for the past three summers. Between summer school and the beginning of his sophomore year he took a tour through New England. He went to summer surveying camp in the six weeks before his junior year.

After graduation in February, Mat is planning to do graduate work in structures and soil mechanics at M. I. T. and Illinois. He intends to secure his doctor's degree before returning to his native China to work for a large construction company. Eventually he hopes to organize a construction company of his own.

# CORNELL SOCIETY OF ENGINEERS

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80 Park Place, Newark, N. J.

*"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the College and the alumni."*

## President's Message

Fellow Cornellians:

In almost every publication today one sees mention of the engineer. Suddenly he seems to have become the man of the hour, the producer of those things which are deemed to be essential to the preservation of the universe. This seems odd, for the engineer has always been the pioneer—even though he may not have been college trained or even conscious of the fact that he was an engineer.

On the other hand, does the engineer realize the importance of this special recognition of his ability? Is he ready to take advantage of this and make his importance all the more essential to the future? Or does he merely believe that he has to go through the usual regimen to which he has become accustomed and pass on into oblivion leaving more or less traceable tracks behind him? Let's look at this. One has only to turn back the pages of history. In these we find that some engineers performed prodigious tasks, the accomplishment of which we are now unable to explain, But who were those engineers? There is almost never a record. But there are records of the mighty warriors whose chief aim was destruction—destruction of human life and property. Today when one travels through the country and takes the time to be observant, he notices it is the warrier that appears in bronze and stone most frequently.

The young engineers who now see their day in the sun must see these things, but are they taking the trouble to make themselves fit? What are they doing in the colleges and schools with the opportunities which present themselves? Are they confining their efforts wholly to getting by? Are they following that which often is the usual routine of the engineering school—memorizing formulae, copying reports made in the past changed only for the basic data on which the report is to be founded, pounding out meals, shaping sand molds, driving stakes all over the campus for pedestrians to stumble over, mixing sand and cement into various shapes, crushing pieces of timber to demonstrate the correctness of a mechanical formula, watching the transit of stars—are these the things which they are doing to make engineers of themselves?

Too often this constitutes the concept of being an engineer. Too often there is little if any thought given to the development and training of the thinking processes which later will be so valuable to them when they come face to face with something which is not explained in the book. Too often the engineer who knows what should be done, and how it should be done, will humbly watch someone else with the ability to lead occupy the place where the engineer should be. Where is the fault, if fault there be? Does it lie with the student? Does it lie with the curricula to which he is subjected? Does it lie with the teachers? The answer to all of these is yes! It lies with the student who fails to get the right perspective of his intents and does not take full advantage of his opportunities to prepare himself. It lies with the curricula in that they too often stress some of the automaton features of the courses which often are drudgery and fail to bring out the latent abilities of the student; it lies with the curricula which fail to include cultural training of the kind which will enable a student to develop more accurately and broadly his thinking processes. It lies with the teacher who continues in this profession when he knows that he cannot inspire his students; who knows that he is uninteresting; who lacks the ability accurately and promptly to impart the knowledge he possesses; it lies with the teacher who fails to modify his procedure when he knows it has become outmoded or realizes that it never was an essential part of the training of the student.

The day of the engineer is here. This world will be sadly in need of the constructive powers of man when this holocaust has been con-

(*Continued on page* 28)

**ON November 27 the New Jersey group of the Cornell Society of Engineers held a luncheon meeting at the Newark Athletic Club, at which new officers for the ensuing year were elected: They are: J. Paul Leinroth '12, chairman Wm. H. Hill '22, vice chairman**

**Sylvester J. McKelvey '27, chairman of Membership Committee**

**Lawrence F. Block '23, secretary-treasurer**

**After the business meeting the movie, "Engineering at Cornell", was very much enjoyed.**

*Two microphones fit against the sides of his Adam's apple. He doesn't have to hold this "mike"—his hands are free.*

# How can a throat microphone help win battles?

This throat microphone is something new—made by Western Electric for the nation's air forces.

It picks up the vibrations from the flyer's vocal cords. Motor roar and machine-gun chatter don't get in to drown out his radio message. And the battle's outcome may depend on that message getting through.

This important device was developed by Bell Telephone Laboratories, pioneers in the field of aviation radio, and was made in the same workshop as your Bell Telephone.

It is among the many benefits which have grown out of Western Electric's long experience as manufacturer for the Bell System.

**Western Electric** *... is back of your Bell Telephone service*

# *The* ALUMNI . . .

Thomas Bissell

## SAE Author

THOMAS A. Bissell, who graduated from Cornell in 1923 as an M.E., has, for the last six years, been technical editor of the *S. A. E. Journal.*

For the last three years Mr. Bissell has written the paper "Design of the New Passenger Cars", which appears each November in the *S. A. E. Journal.* The article for this year stresses the fact that the automobile manufacturers have, "served two masters and served them well"; they have cut down on the use of critical materials and have at the same time incorporated many new improvements. A good many cars have shifted from aluminum to iron pistons and yet, in spite of these changes, most of the 1942 engines are more powerful and some have higher compression ratios. The author, in concluding, warns that car designs will probably be "frozen" for the next few years and that all chrome trim and similar fixtures will be removed, but "there will be a steady redesign of parts to accommodate alternate materials in place of defense-needed critical materials."

## University President

ARTHUR Ripont Keller, C.E. '03, has recently been appointed acting president and executive officer of the University of Hawaii at Honolulu. The appointment is to last until June 1942 or until the end of the present school year. Previously Mr. Keller was dean of the College of Applied Science at the University of Hawaii.

During his undergraduate days at Cornell he was a member of the Cornell Association of Civil Engineers, which corresponds to our present chapter of the ASCE, and a member of Sigma Nu Fraternity.

After obtaining his degree in civil engineering at Cornell, Mr. Keller received a law degree from the National University in Washington, D. C. He was also awarded a master's degree in engineering at Harvard University and at the Massachusetts Institute of Technology.

At present, besides being acting president of the University of Hawaii, he is secretary of the Hawaii Housing Authority and is active in civic affairs there.

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## Chase Advises Foundrymen

IN the August and November issues of *Metals and Alloys,* Herbert Chase, M.E. '08, has undertaken a comparison of permanent mold and die castings. In the article the two are compared as to properties. Some of the properties discussed are porosity, weight, smoothness and appearance, dimensional accuracy, coring and complexity, size of castings, and relative strength. Mr. Chase concludes his two-installment article with the admonition to be careful not to be too exact in drawing up plans for molds or the price of the castings will be prohibitive.

Herbert Chase

## Tatum and Rowing

THE oar pulled by the late Lewis L. Tatum in the historic intercollegiate races of 1895 and 1896, first ever held at Poughkeepsie, has been added to Cornell University's collection of athletic trophies through the generosity of Mrs. Tatum, it has been revealed. She lives in Milwaukee, where Mr. Tatum, before his death in 1932, had for many years been an executive of the Cutler-Hammer Company.

A graduate with the M.E. degree (in E.E.) in 1897, "Lew" as his friends called him, rowed number 7 in two famous varsity races. In 1895, he was a member of the Varsity crew that stayed in this country to row at Poughkeepsie while another crew made its ill-starred trip to England to be defeated in the Henley Regatta.

The Poughkeepsie race was also a fiasco. On the Saturday when the event was scheduled, the Cornell and Columbia crews lined up for the start, only to learn that the Pennsylvania crew could not row,

(*Continued on page* 26)

**Use The Cornell University Placement Bureau**

WILLARD STRAIGHT HALL — H. H. WILLIAMS, '25, Director

# *THE SECOND DISCOVERY OF AMERICA*

In America, science is discovering a vast new world—a stupendous world that Columbus never dreamed of. This new America is boundless. Its riches are infinite, thanks in large measure to the magic of *synthetic organic chemistry.*

One of the discoveries in this field is an amazing series of synthetic plastics—"Vinylite" resins.

In one form or another, these astounding materials appear in such diverse essentials as food-can linings . . . and tank-car linings; as airplane cockpit covers . . . and non-flammable insulation for vital electrical wiring; as corrosion-resistant wrappings for cross-continental pipe lines . . . and welders' goggles; as the thin film on paper which is put inside bottle caps . . . and as the invisible interlayer in the sandwich of safety glass.

"Vinylite" resins can be formed, drawn, laminated, and bonded. In basic form, they are odorless, tasteless, and non-toxic, and range from non-flammable to slow-burning. They can be made stiff or flexible . . . hard or soft . . . colorless or almost any color under the sun . . . transparent, translucent, or opaque. And the result is resistant to oxidation . . . waterproof . . . alcohol-, alkali-, and acid-resistant.

These unusual properties have created a heavy demand for "Vinylite" resins, particularly to meet defense needs. This is why it is not possible, at present, to supply all manufacturers of articles for personal and home use with all the "Vinylite" resins needed. Against the return of more normal times, when larger quantities for normal uses will again be available, manufacturers are invited to test these new plastics . . . to develop new and improved things to be made from them . . . so that all can benefit from the discovery of "Vinylite" resins.

• • •

*"Vinylite" resins and plastics are supplemented by the well-known products of Bakelite Corporation. The resins themselves are produced by Carbide and Carbon Chemicals Corporation. Certain elastic sheetings and films are made from these resins and marketed by National Carbon Company, Inc., under the trade-mark "Krene," while other compounded forms useful in electrical insulation are marketed by Halowax Corporation. The manufacture of all these products has been greatly facilitated by the metallurgical experience of Electro Metallurgical Company and Haynes Stellite Company and by the metal-fabricating knowledge of The Linde Air Products Company. All of these companies are Units of Union Carbide and Carbon Corporation.*

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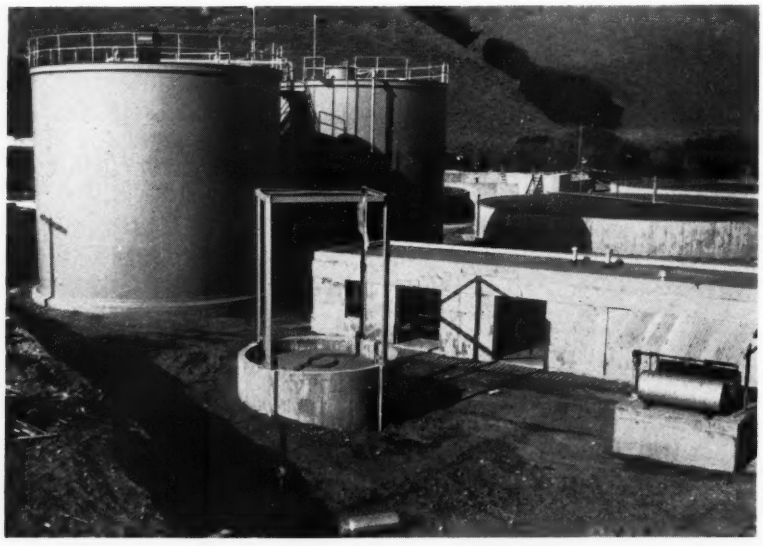
*Producers of Synthetic Organic Chemicals*

## Camp Sanitation

(*Continued from page* 11)

tling tanks, chlorination equipment with a contact period being provided in the outlet sewer. Sludge is to be disposed of by digestion in two large heated tanks, each 55 feet in diameter and about 25 feet deep, and then disposed of by drying on open sand beds and placed in fills.

For the collection and disposal of waste materials such as garbage, trash, rubbish, ashes and the like—a major sanitary problem in Army camps—plans of the camp provide for three 10-ton incinerators. These are especially designed units which have been used by the Army for many years and comprise furnaces of simple design and operation, in order that no highly skilled operators will be required.



**Disposal Plant Not Yet in Operation**

In most Army camps the operation of the incinerators is under the supervision of the Utilities Officer, but the collection and transportation of the refuse to the incinerators is handled by each individual troop unit. In many camps the troop units dispose of edible garbage by contract with hog feeders. Occasionally garbage is delivered to the incinerators in the form of swill, which is not satisfactory as such liquid material will not burn in any furnace.

Drainage to carry away surface and rain water runoff comprises another important sanitary aspect of Army camp designing. The extent and character of such drainage systems depend upon the topography of the camp site and the availability of natural drainage lines into which surface and storm waters may be discharged. The camp has been planned along the two sides of a small stream on slopes with good natural drainage, so that the planned construction includes culverts under roadways, straightening of streams by open ditches, and a limited amount of closed drains.

In Army planning, the designing of drainage structures, for convenience, has been combined with the development of roads rather than with the designing of sanitary sewers.

Swampy areas or stagnant pools located within a mile of the camp are objectionable, particularly in those locations where malaria fever is prevalent. Camp designing should provide for draining of marshy areas if possible, the clearing out of weeds or other vegetation where draining is not feasible, and the construction of roads to permit easy access to any potential mosquito breeding areas so that control measures may be facilitated.

Facilities for recreation and entertainment are being included in the designs of Army camps on a scale never before provided. Each camp for 5,000 troops includes a number of theatre buildings, chapels, service clubs, and a game room for each company.

The design of several proposed camps has been completed by the Construction Division of the Army. Engaged in these activities have been a number of Cornellians. Mr. E. C. Hurd '25 has been architect engineer in charge o the engineering work for one of these projects, with Professor R. Y. Thatcher preparing the specifications; Professor H. T. Jenkins as chief of structural design; Mr. Ivan Bogert '39, as chief of water supply; and the writer as project engineer in charge of contracts and specifications.

## The COLLEGE

(*Continued from page* 13)

or other action, using transparent models of bakelite and polarized light. This method is known as the "photoelastic method". Dr. Drucker's method makes it possible to obtain photographs of fringe patterns in the model which can be interpreted in terms of stress. Many readers will have seen photographs from the photoelastic laboratories representing the stress in models where no bending occurs. Applications of this new method are possible in the study of plates used in aircraft, ship, and pressure vessels' construction.

### Civil Service Course

TWENTY-FIVE civil service employees will soon arrive in Ithaca, to begin a new three-months course in ordnance inspection at the College of Engineering. The course at Cornell is the first of its kind to be set up anywhere in the country. Cooperating with the University are the War Department, the U. S. Civil Service Commission, the Social Security Board, the U. S. Office of Education, and the State Employment Service.

Men selected for this special training by the Civil Service Commission and the Army's Rochester Ordnance District will take classroom work in the fundamentals of engineering as well as a laboratory course in inspection practice, involving machined parts, tools, and gages. The instructional material for the laboratory work was developed in the National Defense Curriculum Laboratory of the State De-

(*Continued on page* 30)

A LUMP OF ZINC ORE—unattractive, insignificant, commonplace!

But with the light of science shining upon it, let your imagination visualize the reflections which emanate from it!

In defense: on land, on sea, in the air, Zinc is an essential in the construction of ammunition, armament, battleships, airplanes. In industry, Zinc enters vitally into the construction of engines, tools and machinery. In agriculture, Zinc in one form or another protects homes, crops, orchards, animals. In ways almost infinite in variety, Zinc is used to effect economy, increase efficiency, improve safety, augment profits.

It pays to KNOW about Zinc. It is essential in defense. In the period of America's greatest industrial development, Zinc has rendered indispensable service; it is reasonable to expect that it will be utilized even more extensively in the greater developments yet to come.

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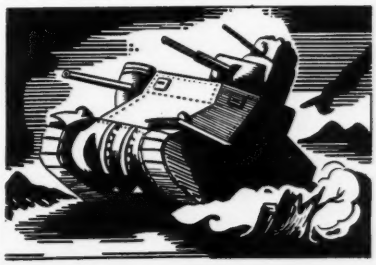

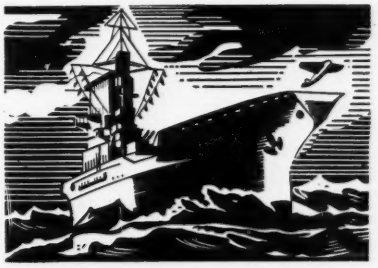

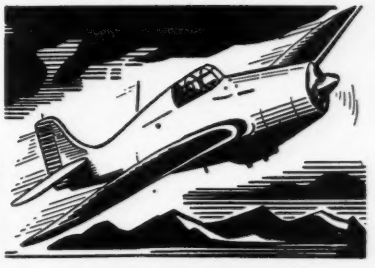

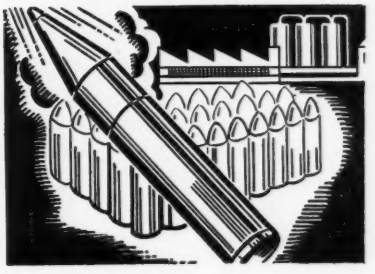

## *Broadcasting*

(*Continued from page 6*)

to avoid possible confusion with the *Elmira Star Gazette.*

Present-day programs include many of the better non-commercial features of the Columbia System, news reports from the United Press, many recorded programs from the World library, and a liberal number of "live" studio programs. Occasionally the station has originated programs for coast-to-coast broadcasting over the Columbia System, and it is continuing to do so. The expenses of operation are defrayed by the sale of advertising time, and local commercial organizations have contributed liberally to the maintenance of the station by the purchase of nearly all of the advertising time available.

On account of the night-time interference which would be produced on the frequency of 870 kilocycles to station WWL of New Orleans, which operates on this frequency, the Cornell station is required to suspend operation at the time of sunset at New Orleans. The handicap of not being able to continue operation at night is a serious one, and applications are at present on file with the Commission for facilities which would allow full time operation. So far the Commission has taken no action on these requests.

The technical equipment of the studio, while not as elaborate as that of larger and more important stations, is of high quality and adequate for the present needs. The transmitting equipment, although originally of 1926 vintage, has been periodically redesigned and brought up to date to keep step with the ever increasing technical demands of the Federal Communication Commission.

From the standpoint of program material, technical operation, and general public acceptance, the station compares favorably with other limited-time, small-town stations of its power rating. There is every reason to believe that the improvements which have been made in the past will be continued until the station can assume a position of leadership among the educational broadcasting stations operating in the United States.

No story of Cornell broadcasting would be complete without a word about "Station CRG". A few years ago a group of enterprising electrical seniors conceived the idea of placing tiny broadcasting stations, with a range of only a few hundred feet, around the campus in the various dormitories and fraternity houses, connecting these stations with a leased telephone wire, and broadcasting a program of particular interest to the University community. The little individual transmitters cannot be heard outside the building in which they are located, but inside the building they can be picked up on any ordinary radio set. Accordingly the Cornell Radio Guild, the student organization which sponsored the enterprise, has a well-equipped studio in one of the Willard Straight activity rooms and has for some time been furnishing a regular program to its subscribers. This program includes popular music, items of particular interest to the student body, sports events, and enough commercial programs to defray the costs of operation. The system, operated entirely by the students, offers almost unlimited opportunity in all phases of broadcasting activity; announcing, program direction, program preparation, technical operation, and commercial time sales are all carried on by students, and the project seems well worth while from a number of different angles.

When it is remembered that much of the original endowment of Cornell University was derived from the commercial success of a great communication organization, the Western Union Telegraph Company, it is particularly fitting that Cornellians have been, are, and will be vitally interested in the development of the great art of electrical communication.

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## Pierre Yakovleff

(*Continued from page 17*)

school; then, however, he was drafted and sent to an artillery training camp in Lyon. After a rushed six-months course, he passed the tests and was given his commission as a 2nd lieutenant; he was rushed toward the front, but was only able to take part in the general retreat.

He stopped in Lyon, took off his uniform, and stayed. The Germans occupied the town the 19th of June; but he was allowed to move about the city unhindered. Then the armistice came, and the Germans withdrew. At that time Pierre's future was very uncertain. However, in February, the news came to him that a friend of his father's in America had obtained the necessary papers and a tourist visa for him to come to America. The problem then was to get out. It was against the law for any man between 18 and 45 to leave France. However, Pierre says, a marvelous series of lucky breaks and a lot of patience and persuasion enabled him to obtain his passport and finally to escape from Marseilles to Algeria.

From Algeria he proceeded through Morocco to Casablanca, where he had to wait for two months for a ship which could take him to Lisbon. From there is was another long voyage on a Spanish ship to Havana and then to New York, where he arrived in February, 1941.

After getting settled in New York, he attended NYU during the summer, where he learned English and picked up a few other courses; then, by another stroke of luck, he obtained a McMullen Scholarship under special consideration, and is now here as a junior. He is a member of the Cosmopolitan Club, and of the French Club. His favorite sport is riding, and he has done some here at Cornell, though he says he has not been here long enough to really get in the swing of things. He is still having some trouble with the language, but all in all he is having a wonderful time.

The future is very uncertain, though, he admits. As he is a holder of a Vichy passport, there is a possibility that he might be forced to leave the country as an alien; and if the Free French government is recognized, there is a possibility that he would have to go immediately into the army. At the present time, he is just waiting. He would like to continue his courses here and get an American degree, as he says that degrees received here have a very high standing in Europe.

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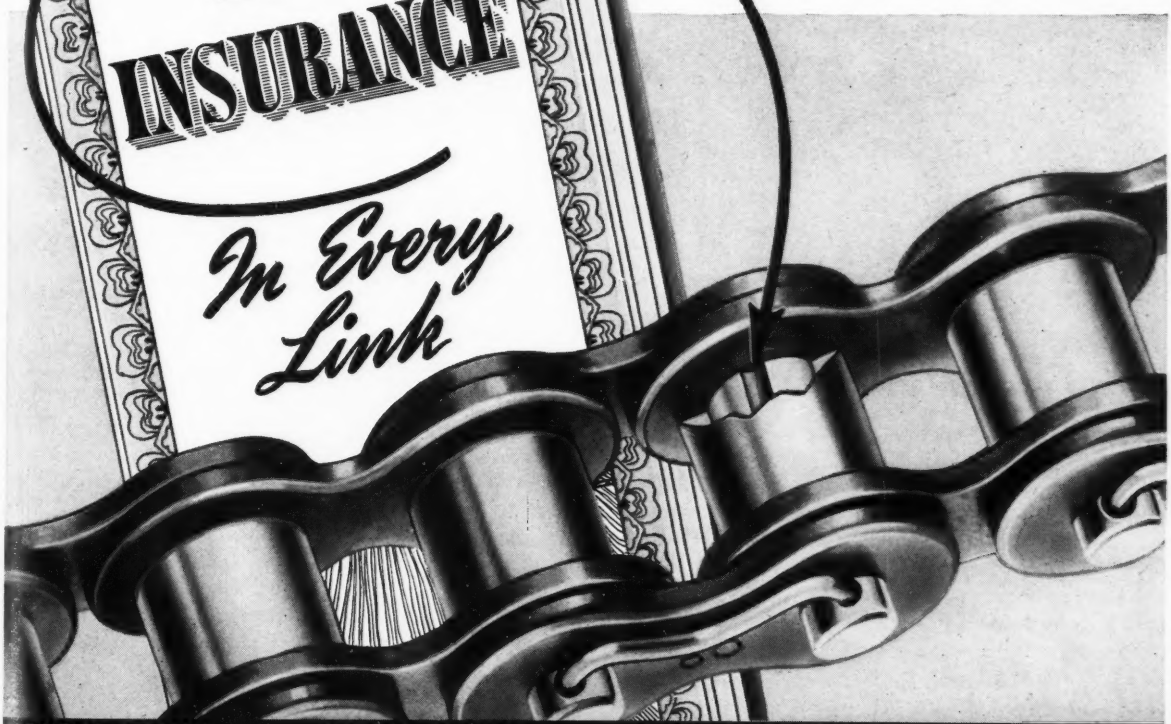
Next time you buy roller chain, specify MORSE!



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During the past 41 years over 1000 thrifty students graduating from the Engineering College at Cornell University have created estates in excess of $5,000,000 by buying life insurance and annuity policies from the

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## *The* ALUMNI

(*Continued from page* 20)

since a large boat carrying Governor Odell's party had cruised past the dock at great speed just as the Penn shell was put into the water, and the shell had been smashed against the float. The race was finally rowed on the following Monday in a heavy squall, with the waves on the Hudson so high that the Penn shell sank before reaching the line and the Cornell shell was swamped just after the finish. It is the belief of members of the Cornell crew, according to Professor Hugh Troy, who was one of them, that Columbia won because someone had had the foresight to install a pump that could be worked by the coxwain's feet. Tatum, Troy, and the other Cornell oarsmen were rescued, with the broken pieces of their shell, by spectators in rowboats and launches. These broken fragments were retained by the Cornell oarsmen as souvenirs.

The Courtney crew of 1896 fared better. With the weather more favorable and the river patrolled according to a scheme authorized by a special act of Congress, Cornell defeated Harvard, Pennsylvania, and Columbia, covering the four-mile course in 19.29 minutes, a record that stood several years.

When the Cornell crew of 1906 also won at Poughkeepsie, Mr. Tatum immediately sent Edward T. Foote '06, stroke and commodore of the crew, an offer to join his corporation. Foote accepted the offer, and served with Cutler-Hammer for 22 years.

Despite the fact that Tatum had to help pay his own expenses in college, he was active in various undergraduate activities and organizations. He was a member of the freshman football team, was sophomore class navy director, and a member of Aleph Samach, Sphinx Head, the Sibley Journal board, the Student Council, and several other campus groups, besides rowing on the varsity crew.

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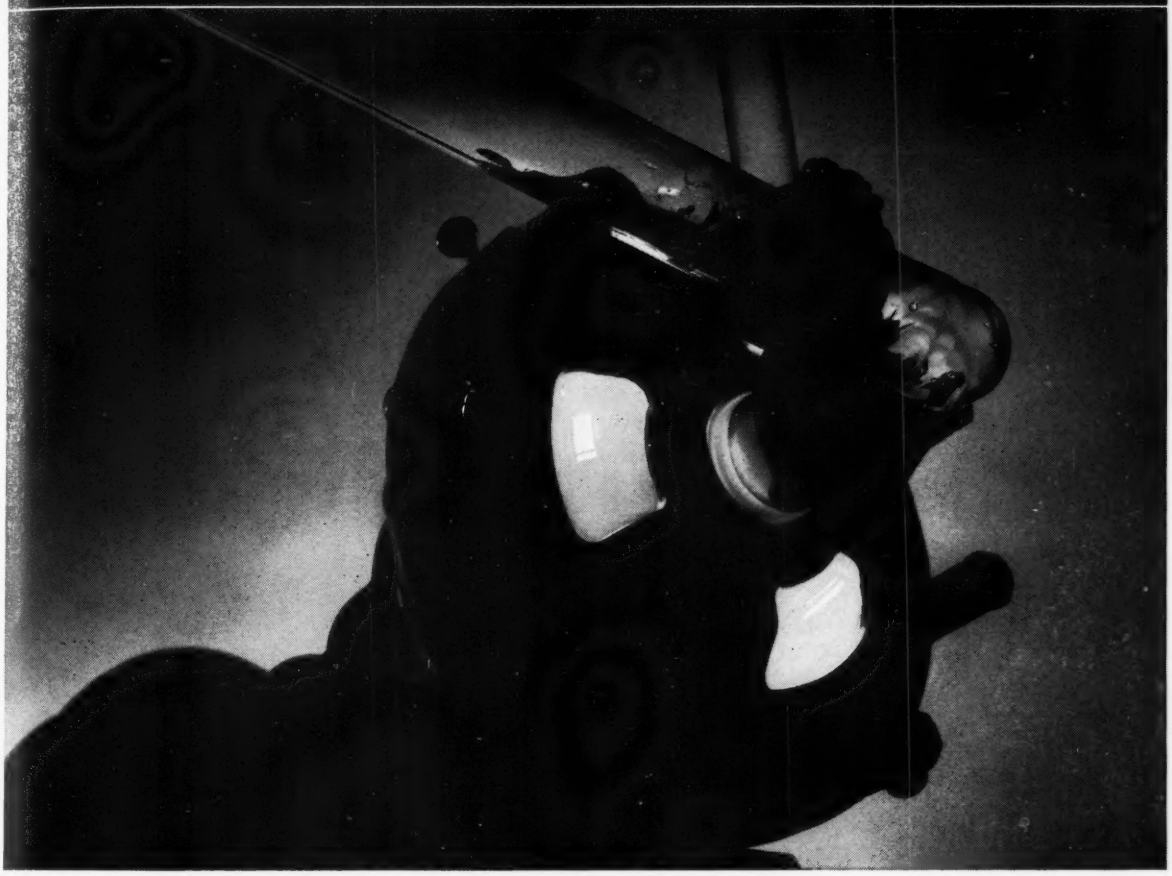
### Address: War Zone

SPEAKING of Hawaii, we thought that you would be interested to know which of your classmates are "in the thick of it" over there right now. So we find that Major Peter E. Bermel, C.E. '15, and Major R. G. Barrows, M.E. '10, are in Honolulu serving in the Corps of Engineers. Major Arthur E. Rowland, M.E. '12, is with the Coast Artillery there. At Fort DeRussy in Honolulu one of the captains of the Coast Artillery is Captain Bernard C. Dailey, C.E. '17.

Captain William H. Mills, C.E. '28, is with the Third Engineers at Schofield Barracks, as well as Lieutenant Walter Krueger, Jr., C.E. '34, Lieutenant John J. Gillespie, C.E. '33. Lieutenant Lawrence J. Ellert,

(*Continued on page* 30)

# Here's the Glass pump that couldn't be built...



THE ENGINEER from the Chemical Works had one of his usual headaches.

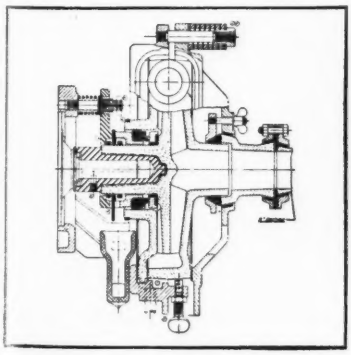
"We're pumping hot corrosive acids through your glass pipe, and it lasts for years," he moaned, "and the works bogs down because the pumps can't take it! Can't you people build a glass pump?"

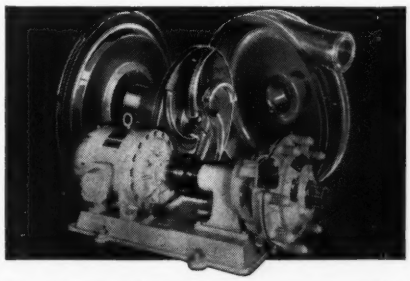
It sounded impossible. Pump makers said it couldn't be done. Such a pump required not only highly resistant glass but also intricate parts, accurate to thousandths of an inch! Even Corning had doubts but decided to tackle the problem.

Pooling its ideas with Nash Engineering Company's knowledge of pumps, Corning devised new methods of glass manufacture, even a new type of glass for certain parts.

And today chemical, food and beverage plants, and other industries handling corrosive solutions have a glass pump that works like a charm. Resistant to corrosion, it eliminates a cause of product contamination and undesirable chemical reactions. Resistant to heat shock, it may be cleaned with hot acids. Transparent, it permits constant visual inspection for cleanliness, color, sedimentation.

In the same way, Corning research for three quarters of a century has licked such glass problems as the bulb for Edison's first lamp, cooking ware for housewives, and tiny glass springs for chemical equipment. And in these days of metal-conservation, Corning ability has reached a new high in usefulness as engineers and production men use glass to solve their new problems. Industrial Division, Corning Glass Works, Corning, N. Y.





*The Nash Glass Centrifugal Pump (left— cross section; above —coupled with driving motor, glass pump parts in background) can handle up to 6000 gal. of corrosive acids and chemical fluids per hour against a 65-ft. head.*

CORNING
*means*
Research in Glass

## Ching Te Wu

(*Continued from page* 16)

Carl is an individual of many interests. He loves to swim and skate. He is an avid reader of contemporary nonfiction, preferring such authors as John Gunther, Edward R. Murrow, and William L. Shirer. His collection of stamps from all over the world is of unusual interest, for not one of them has ever been cancelled. By far, however, his favorite diversion is to sit down with his favorite pipe and listen to Toscanini conducting or to listen to a violin solo by Heifetz or Kreisler. Actual concerts are all the more precious to him, for when he returns to China, there will be only his private recordings to draw from.

His opinions on China's position in the world situation are heartening. He believes that although China was losing ground in the beginning of the war, they were gaining spirit and morale. Now with America's entrance into the war, Chinese morale has been bolstered to its highest level in many years of fighting with Japan. "China has always regarded the United States as her traditional friend, and today her ever present hope of mutual assistance has been realized in fact".

When he graduates, Carl expects to return to China where he would like to work in the factories. His main interests lie in the textile field, and he possesses several personal theories which he hopes some day to test. If his past record is any indication of his future, a life of service and achievement lies ahead. We wish him the best of luck, or in Chinese, "Chien Cheng Shun-Li."

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## *President's Message*

(*Continued from page* 18)

cluded. Who is to lead in this work? Who is to be responsible for the development of new ideas, for the utilization of discoveries born of necessity, for the production of new modes of life which will make it possible for an impoverished humanity to live in decency and reasonable comfort? It is the engineer—the chemical, the mechanical, the electrical, the agricultural, the physical, the civil, the aeronautical, the Naval, the Army, the radio, and all of the rest of the engineers who really do things. Young men, ponder over these things and then take stock of what you are doing. Older men, recollect your past and envision the future. There is much to be done.

---

## We Acknowledge

We wish to thank *Army Ordnance Magazine* for the cuts used to illustrate last month's article "The Ears of Our Army".

We also extend our thanks to the *Excavating Engineer* for the cut used in last month's "Stress and Strain."

*No* **GUNS** *without* **GAGES**

Parts for guns and gun mounts are made in different factory departments, often in different factories. Without thousands of gages of all kinds, it would be impossible to control manufacturing operations so the finished parts fit when they come together.

Greenfield Tap and Die Corporation is one of the largest and oldest gage manufacturers in the country.

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*For Victory*

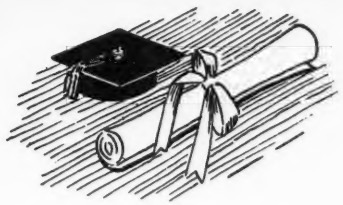
*BUY*

DEFENSE BONDS

and

STAMPS

V



When the war is over, machinery of all kinds will be closely scrutinized for its ability to meet the changed conditions. Thousands of machines will be redesigned to give them higher speed, greater precision and lower operating costs in order that their users will be able to compete at a profit.

The greatly increased use of Timken Tapered Roller Bearings will be one of the most important factors in securing these results. In many machines—previously only partially Timken Equipped—Timken Bearing advantages will be extended to every rotating member. Many other machines will be given new and higher standards of performance through the use of Timken Bearings for the first time.

When you have gained a thorough understanding of Timken Bearings and their application you will be able to solve any bearing problem you may encounter and get 100% results. Begin to acquire that knowledge now; send for a free copy of the Timken Reference Manual.

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## *The* COLLEGE

(*Continued from page* 22)

partment of Education at Cornell. Dr. Lynn A. Emerson, professor of industrial education, directed the preparation of the material, which has now been adopted for use in all the 13 Army Ordnance Districts, where similar courses will be set up.

The new course will be administered under the Engineering, Science, and Management Defense Training program, directed at Cornell by Dr. Adams, with Professor S. S. Garrett of the College of Engineering in charge of instruction and Dr. Emerson as consultant.

After graduation from the course at Cornell, the men will be recommended for civil service promotion as junior inspectors of ordnance.

### Wind Tunnel

UNDER the direction of Professor V. R. Gage, '06, Lynn E. Bussey, ME '42, is designing a wind-tunnel for use in the Department of Experimental Engineering. At the present time plans are nearly complete and construction is well under way in Rand Hall.

The tunnel is 30 inches in diameter at the test section and approximately 20 feet long. It consists of three units, the entrance cone, the test section, and the exit cone. Air is drawn through the tunnel and discharged at the end of the exit cone by a centrifugal blower. Powered by a 40 h.p. direct current motor, the blower has a capacity of about 50,000 cubic feet per minute. It is estimated that the air stream will flow through the test section at least 100 miles per hour.

## *The* ALUMNI

(*Continued from page* 26)

M.E.'31, is serving with the 55th Coast Artillery at Fort Ruger, Honolulu. One of the second lieutenants of the 674th Ordnance Company at Wheeler Field is Howard C. Mandeville, B.S. in A.E. '37. Lieutenant John J. Gillespie, C.E., '36, is at the 251st Coast Artillery Camp in Malahole, Oahu.

Ensign Stuart B. M'Kinney and Theodore W. Lanman both B.S. in A.E. (M.E.) '41, are on duty at the Naval Station in Pearl Harbor. John M. Young, M.E. (EE) '02, is professor of Engineering at the University of Hawaii. A. A. Scott, M.E. '08, is vice-president and general manager of the Mutual Telephone Company in Honolulu. B. P. Carpenter, M.E. '21 is assistant vice-president and sales manager of the Hawaiian Gas Company, Lt'd. in Honolulu. Henry C. Boschen, M.E. '28 is working on Pacific Naval Air Bases in Honolulu. Mr. Ronald G. Watt, M.E. '23 is with the Pioneer Mill Co., Ltd. in Lahaine Maui, T. H.

### Cornell Author

INCLUDED in our list of Cornell authors is V. Larry Dzwonczyk, E.E. '35. His timely article on "Our American Government, What Is It? How Does It Function?" appeared in the November issue of the *Bridge of Eta Kappa Nu.*

# LANCES OF FIRE THAT SLICE STEEL

FASTER than ever before man shapes steel to meet his needs, slicing it to the desired shape with the oxyacetylene flame — the modern cutting tool which never dulls. It shapes thin gauge sheet or heavy slabs; forgings and structures with equal ease, and with truly astonishing accuracy.

New, better and faster ways of making machines, engines, ships, tanks and innumerable other products is the direct result of the efficiency and proper application of this modern production tool.

But the oxyacetylene flame does not content itself merely with being the outstanding metal cutting tool. Because of its versatility, it finds wide and varied application in speeding defense. It hardens steels to any desired degree and depth; cleans metal surfaces for quicker and longer lasting paint jobs; gouges out metal with astonishing speed and accuracy, and welds metal together into a homogenous unit. To aid and expand production schedules by the most efficient and economical application of the oxyacetylene flame, Air Reduction makes available to industry the practical cooperation of a skilled engineering department.

"Airco in the News" shows many interesting uses of the oxyacetylene flame and electric arc. Write for copy.

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# STRESS and STRAIN...

Pity the poor professor who received the following question. Student: "Sir, there is one thing that is puzzling me. If you square a negative number, you get a positive number. If you cube a negative number, you get a negative number. But what will you get if you raise it to the two and one-half power?

* * *

Colonel instructing fliers: "Now, what's the first thing you do upon making a landing?"

Pupil: "Thank God."

* * *

**Professor: "You missed my class yesterday, didn't you?"**

**Senior: "Not in the least, sir, not in the least."**

* * *

Professor (after bad recitation): "Class is dismissed. Don't flap your ears as you go out."

* * *

Bridegroom: "I thee endow with all my worldly goods . . ."

His father: "There goes his bicycle."

* * *

The Japanese proudly announce that they have a thousand men who are willing to drive torpedoes at the risk of their own life. We have several million who are willing to drive automobiles.

* * *

**Connect 20,000 volts across a pint. If the current jumps it, the product is poor.**

**If the current causes a precipitation of lye, arsenic, tin, iron slag and alum, the whiskey is fair.**

**If the liquor chases the current back to the generator, you've got good stuff.**

Prof: Now, class, can anyone give me an example of wasted energy.

Student: Yes sir—telling a baldheaded man a hair-raising story.

* * *

**After a rather serious accident the policeman was making an investigation.**

**"How did you knock him down?" he asked.**

**"I didn't," the poor motorist replied. "I slowed down to let him go across—and he fainted."**

* * *

In days gone by in a little town out West a wagon driver once pulled his wagon up in front of the general store and dismounted.

On the porch of the store he was confronted by an ancient settler. "What ye' got in the wagon?" was the old gent's greeting.

"Nitroglycerine," replied the driver.

"Kind'a dangerous ain't it?" queried the native.

"Not much," replied the driver. "I don't expect to ever have more than one accident."

* * *

At one of the frosh hygiene lectures Dr. Smiley was discussing at some length the evils of alcoholic beverage. He illustrated thusly: "If you give a donkey the choice of drinking a bucket of water or a bucket of beer, which will he choose?"

At which climax the proverbial voice from the rear of the room shouted out, "The water, of course."

Hoping to quell the disturbance, Dr. Smiley ventured the question: "And why, my good sir, did the donkey choose the water?"

In quick retort came the heckler's voice, "Because he's an ass."

Two little boys were watching a little girl across the street.

First little boy: "Her neck's dirty."

Second little boy: "Her does, does her?"

* * *

A beautiful coed (from some other school) was wearing a blue sweater: it was one of those marvelous form fitting kind.

Said she, coyly: "Don't you think it brings out the blue in my eyes?"

He: "Gulp."

*—Wayne Engineer*

* * *

And while we're about it — a debutante is like an expensive gown . . . . tight in the best places.

* * *

A true lover of music is a man who, upon hearing a soprano in the bathroom, puts his ear to the keyhole.

* * *

**A big buck Indian had just ordered a ham sandwich at a drug counter and was peering between the slices of bread when he turned to the waiter and said: "Ugh, you slice 'em ham?"**

**The waiter replied, "Yes, I sliced the ham."**

**"Ugh," grunted the Indian, "You damn near miss 'em."**

* * *

Time is the thing that keeps all things from happening at once.

* * *

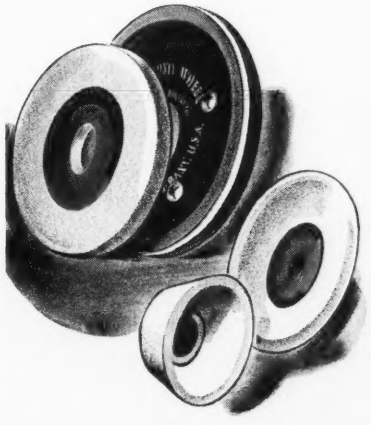
Greatly agitated, a young wife dashed into a drugstore with her first born under her arm. "My baby has swallowed a bullet," she cried, "what shall I do?"

"Give him some castor oil," replied the druggist calmly, "but be sure you don't point him at anyone."

# Making Hell-Buggies in a hurry!

It's the first tanks, bombers and guns that make the headlines. But it's their steady day to day production that really counts. And it's keeping machine tools operating at top efficiency that makes this possible. This calls for the regular grinding and conditioning of every tool and die...a task that is done in the tool rooms of industry, where Carborundum-made grinding wheels are doing one of their most important defense jobs.

Thousands of vital parts are being turned out by the reamers, milling cutters, broaches, hobs, drills, taps and dies that Carborundum-made tool-room wheels help keep at work on the production lines. Carborundum Brand Diamond Wheels are speeding the grinding of cemented carbide tools, and special Aloxite Brand "AA" and other types of cool-cutting wheels are grinding tools of steel.



As Engineers in Industry you will find that our outstanding research, manufacturing and engineering facilities enable us to render a real service on tool-room grinding, or any other job that calls for grinding wheels or coated abrasives. The Carborundum Co., Niagara Falls, N.Y.

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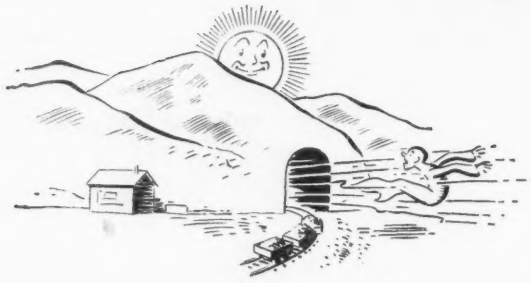
# G-E Campus News

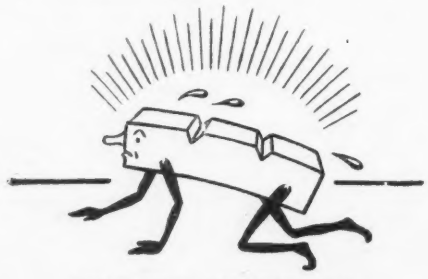


## STEP ON THE GAS!

STEPPING on the gas to produce a speed increase of six feet per day along a highway wouldn't break any speed laws. But six feet extra per day makes engineers hang on their hats when the traveling is through solid rock. And that's the added progress being made by the company excavating the eastern portal of the new 13-mile Continental Divide tunnel by the installation of a new ventilating system utilizing G-E motors and control.

The system saves 20 minutes in the time between shooting each blast in the tunnel and getting back to drilling again. Fans spaced along the tunnel start up immediately after the blast, suck out the gas and smoke, and then reverse and blow fresh air into the tunnel. The fans start in sequence, with an interval of 20 seconds between each, so as to prevent building up large differences of pressure.

The tunnel is being excavated by the S. S. Magoffin Company, under the direction of the U. S. Bureau of Reclamation, to bring water for irrigation and power from Grand Lake, on the western slope of the Continental Divide, to the eastern slope.



## CREEPY BUSINESS

STEEL, or any other solid material for that matter, deforms and creeps when subjected to heat and stress. But how much a given piece of steel in, say, a steam turbine, is going to creep during its life of 10 or 20 years is something a designing engineer can't wait 10 or 20 years to find out.

That's why all sorts of accelerated creep tests have been tried—ways to get a hurry-up prediction of the behavior of metal in service. Dr. Saul Dushman (U. of Toronto '04), assistant director of the G-E Research Laboratory, has thrown some new light on this problem by devising a method that produces extensions in length of as much as half a per cent an hour. By it he can get information in a day or two that would have required months by older methods.

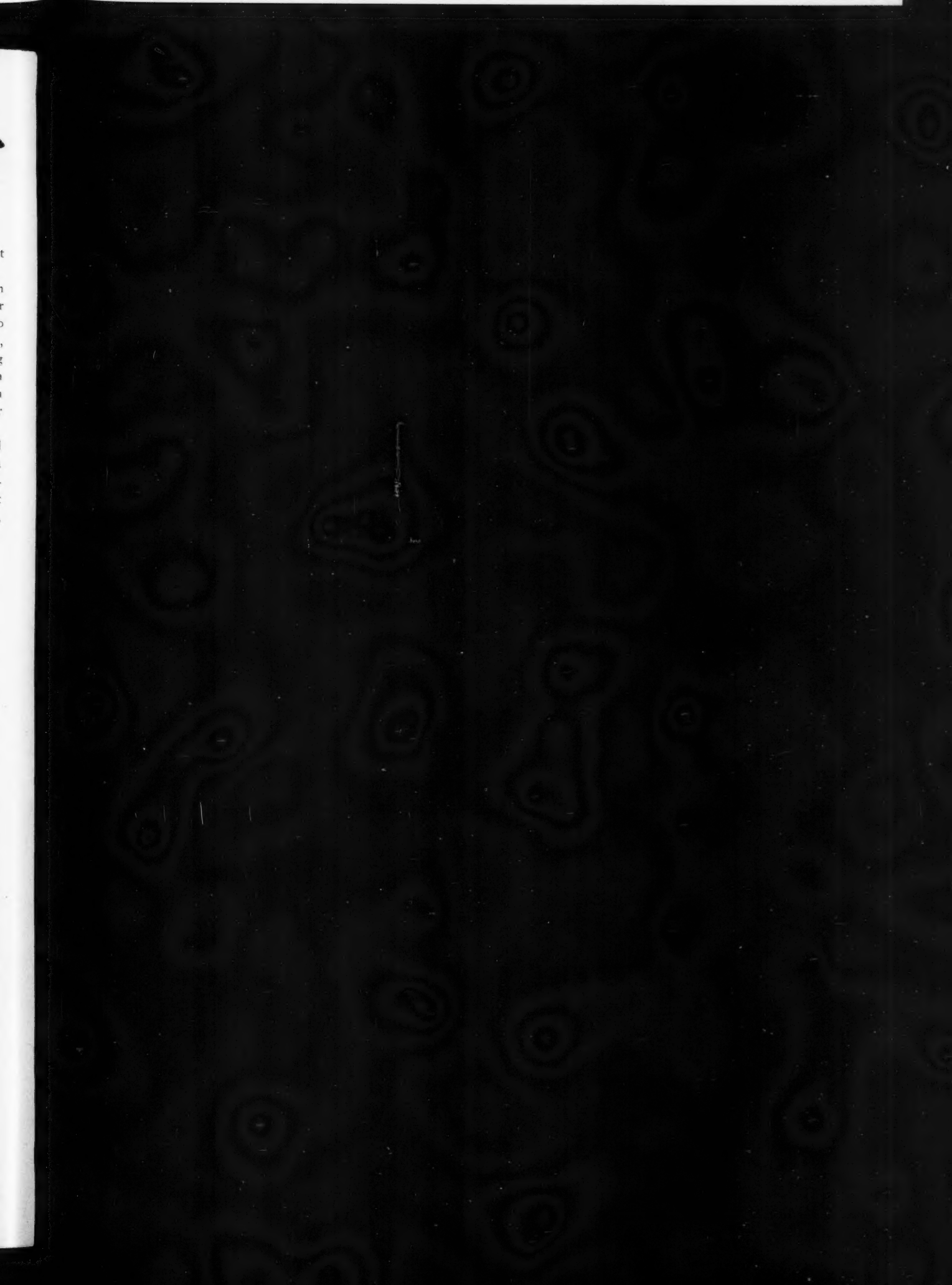
The method consists of loading a thin wire of the metal with a weight, heating it with an electric current to a bright red heat in an atmosphere of nitrogen, and measuring the extension. The results seem also to suggest that creep does not occur atom by atom along the length, but rather in the movement of groups of atoms numbering from 50 to 1000.

## 95% PERFECT

MILADY will find her reflected charms brighter if her mirror is coated with silver, but that reflection will wear better if the coating is aluminum. That's what Frank Benford (U. of Michigan '10) and W. A. Ruggles, of the G-E Research Laboratory, found when they tested 37 kinds of mirror surfaces.

Silver evaporated onto the front surface of the mirror from an electric filament reflected 95 per cent of the incident light. The initial score for aluminum was only 88 per cent. But six months later the aluminum mirror was just as good as ever, while the silver one had deteriorated considerably.

Gold, incidentally, scored third among the pure metals, reflecting 82 per cent of the light. But while all the other metals gave their best results when evaporated on the front surface of the mirror, gold worked best when deposited on the back, as is the practice with ordinary looking glasses.

GENERAL ELECTRIC

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